SD-TR-82-36

HAZARDOUS WASTE INVENTORY FOR SD OPERATIONS AT VANDENBERG AFB

VOLUME II. HAZARDOUS WASTE DISPOSAL ASSESSMENT

FINAL REPORT

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APRIL 1982

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PREFACE

This report was prepared by SCS Consulting Engineers, Inc., Long Beach, California 90807. This Hazardous Waste Inventory for SD operations at Vandenberg Air Force Base (VAFB) was initiated by the U.S. Air Force to meet the requirements of the Resource Conservation and Recovery Act (RCRA) of 1976, as amended in 40 CFR 261 and 264, May 19, 1980, and the California Administrative Code, Title 22, Division 4. The report will be used as a reference document to the 1978 Space Shuttle Supplement 1. It will also be used for hazardous waste reporting to EPA/California, for hazardous waste management planning, and for engineering design concepts for SD operations at VAFB.

The report is in two volumes. Volume I is an inventory of hazardous wastes likely to be generated by the Titan and Atlas programs and by the Component Cleaning Facility. Volume II is an assessment of the potential effects of these wastes on the treatment/recovery/disposal options considered for those wastes generated by the STS ground operations at VAFB.

This work was accomplished between August 1981 and February 1982. Mr. John R. Edwards, Headquarters Space Division, was the Project Officer.

This report has been reviewed by the Office of Public Affairs (PA), and is releasable to the National Technical Information Service (NTIS). At the NTIS, it will be available to the general public, including foreign nations.

This report has been reviewed and is approved for publication.

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This study evaluates the impact of wastes generated by the Titan- and Atlas-related ground operations on the treatment, recovery, and disposal options identified for the STS program. Wastes with similar characteristics are grouped into treatment categories. Descriptions and impact assessments for each treatment category are provided, along with applicable regulatory constraints. Necessary additional equipment and facilities were identified, and the impacts on the associated cost estimates were assessed.

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The Titan and Atlas programs overlap with the space shuttle program only in the early years of the STS. Consequently, treatment and disposal facilities designed to handle the maximum shuttle loading can accommodate most other SD wastes. Furthermore, existing transport, storage, treatment, and disposal arrangements for Titan and Atlas wastes can be easily integrated into the STS waste management plan with no additional cost.

The only SD wastes not readily integrable into the STS waste management plans are the Titan deluge water, hydrazine-contaminated alcohol from SLC 4, and metal finishing wastes containing chromium and cyanide. Treatment and disposal options and their associated costs are discussed.

A combined inventory of all SD wastes (STS, Titan, Atlas, and CCF) by treatment category is also presented.

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SECTION 1

EXECUTIVE SUMMARY

1. INTRODUCTION

The facilities covered in this report are the Atlas and Titan Launch Facilities (SLC 3 and SLC 4, respectively) and the Bionetics Component Cleaning Facility (CCF). The purpose of this report is to assess the potential effects of the additional wastes from these facilities on the treatment/disposal options considered for those wastes generated by the Space Transportation System (STS) ground operations at Vandenberg Air Force Base (VAFB), including the associated cost estimates.

2. GROUPING OF WASTES

An essential step in any discussion of treatment, reuse, and/or disposal of hazardous wastes from Space Division (SD) operations is the grouping of similar wastes into treatment categories. Many of these wastes are compatible in terms of their chemical and physical properties, and as such can be readily mixed and treated or disposed of together. These wastes then constitute a treatment category.

The procedure used to develop treatment categories for the Titan and Atlas hazardous wastes at VAFB was analogous to that used for the STS wastes. Namely, those categories already defined for Kennedy Space Center (KSC) were used to the extent possible to facilitate comparisons between the two sites. The 15 treatment categories are as follows:

- Category 1: Recoverable Freon Wastes.
- Category 2: Hypergolic Fuels and Hypergolic Fuel-Contaminated Water and Alcohol.
- Category 3: Group I Hydrocarbon Wastes.
- Category 4: Bilge Water and Water Contaminated with Oil.
- Category 5: Group II Hydrocarbon Wastes.
- Category 6: Recoverable Silver Wastes.
- Category 7: Recoverable Mercury Wastes.

- Category 8: Acids, Bases, and Aqueous Solutions Contaminated with Metal Ions.
- Category 9: Solid Rocket Booster (SRB) Rinse Waters.
- Category 10: Acid and Basic Wastes Which Contain No Significant Metal Ions (Plus Oxidizer Wastes).
- Category 11: Fuel Vapor Scrubber Wastes.
- Category 12: Oxidizer Vapor Scrubber Wastes.
- Category 13: Combustible Solids.
- Category 14: Noncombustible Solids.
- Category 15: Miscellaneous Wastewaters.

Categories 6, 7, and 12 have no counterpart SD-VAFB waste, and thus are not used in this report.

Tables 1, 2, and 3 present summary annual waste generation rates by treatment category for SLC 3, SLC 4, and CCF, respectively. Table 4 gives the combined totals for all three facilities.

3. RECENT REGULATORY CONSTRAINTS

On October 13, 1981, the Governor of California signed an Executive Order designed to eliminate the land disposal of pesticides, PCB's, cyanides, toxic metal wastes, halogenated organics, and non-halogenated volatile organics.

Given the general descriptions of the waste streams covered by this Order, all of Categories 5 and 8 and parts of Categories 2, 3, and 11 from the Atlas/Titan/CCF will be affected. Within a few years (by the time the STS becomes operational at VAFB), land disposal of these wastes will be prohibited. In the interim, the State of California is considering imposing higher fees on the land disposal of these wastes until such time as the land disposal ban is implemented.

Suggested landfill alternatives include waste reduction; waste recycling; physical, chemical, and biological treatment; high-temperature incineration; and solidification/stabilization. Details on the implementation of the Executive Order are still forthcoming, and major changes, some of which could affect the SD wastes, are possible. However, the analysis presented in this report is based on the assumption that land disposal in California will no longer be permitted for those wastes specified in the Executive Order. Out-of-state land disposal is still a possibility.

TABLE 1. BASELINE WASTE GENERATION FOR TITAN AND ATLAS PROGRAMS BY TREATMENT CATEGORY

ATLAS LAUNCHPADS (SLC3)

	1982		1983		1984		1985		1986		1987 & 88 (PER YR)	
TREATMENT CATEGORY	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF
3	3733.6	444.0	3733.6	444.0	3733.6	444.0	3733.6	444.0	3733.6	444.0	1866.8	222.0
5	13636.8	1214.0	13636.8	1214.0	13636.8	1214.0	13636.8	1214.0	13636.8	1214.0	6818.4	607.0
11	850.6	102.0	850.6	102.0	850.6	102.0	850.6	102.0	850.6	102.0	425.3	51.0
13	235.6	4.8	235.6	4.8	235.6	4.8	235.6	4.8	235.6	4.8	117.8	2.4

TABLE 2. BASELINE WASTE GENERATION FOR TITAN AND ATLAS PROGRAMS BY TREATMENT CATEGORY

TITAN LAUNCHPADS (SLC4)

	1982		1983		1984		1985	
TREATMENT CATEGORY	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF
2	13114.4	1890.2	32786.0	4725.5	13114.4	1890.2	26228.8	3780.4
10	668057.3	80004.6	1670143.3	200011.5	668057.3	80004.6	1336114.5	160009.2
11	830.0	100.0	2075.0	250.0	830.0	100.0	1660.0	200.0
13	720.0	14.8	1800.0	37.0	720.0	14.8	1440.0	29.6

TABLE 3. BASELINE WASTE GENERATION FOR TITAN AND ATLAS PROGRAMS BY TREATMENT CATEGORY

COMPONENT CLEANING FACILITY

TREATMENT CATEGORY	1982		1983		1984		1985		1986		1987 & 88 (PER YR)	
	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF
5	3762.0	330.0	3762.0	330.0	3762.0	330.0	5643.0	495.0	5643.0	495.0	5643.0	495.0
8	609148.6	73000.0	609148.6	73000.0	609148.6	73000.0	913723.0	109500.0	913723.0	109500.0	913723.0	109500.0
10	3045742.5	365000.0	3045742.5	365000.0	3045742.5	365000.0	4568614.0	547500.0	4568614.0	547500.0	4568614.0	547500.0

TABLE 4. BASELINE WASTE GENERATION FOR TITAN AND ATLAS PROGRAMS BY TREATMENT CATEGORY

TITAN & ATLAS PROGRAMS COMBINED

TREATMENT CATEGORY	1982		1983		1984		1985		1986		1987 & 88 (PER YR)	
	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF
2	13114.4	1890.2	32786.0	4725.5	13114.4	1890.2	26228.8	3780.4	.0	.0	.0	.0
3	3733.6	444.0	3733.6	444.0	3733.6	444.0	3733.6	444.0	3733.6	444.0	1866.8	222.0
5	17398.8	1544.0	17398.8	1544.0	17398.8	1544.0	19279.8	1709.0	19279.8	1709.0	12461.4	1102.0
8	609148.6	73000.0	609148.6	73000.0	609148.6	73000.0	913723.0	109500.0	913723.0	109500.0	913723.0	109500.0
10	3713800.0	445004.6	4715886.0	565011.5	3713800.0	445004.6	5904729.0	707509.3	4568614.0	547500.0	4568614.0	547500.0
11	1680.6	202.0	2925.6	352.0	1680.6	202.0	2510.6	302.0	850.6	102.0	425.3	51.0
13	955.6	19.6	2035.6	41.8	955.6	19.6	1675.6	34.4	235.6	4.8	117.8	2.4

4. IMPACTS OF TITAN, ATLAS, AND CCF WASTES ON STS HAZARDOUS WASTE MANAGEMENT

The contribution of wastes generated by the Atlas, Titan, and CCF facilities to the total SD waste load is shown in Table 5. It should be noted that the treatment systems discussed in the Space Shuttle report were based on a maximum of 15 launches per year, whereas the more recent projection is 10 launches per year.

In view of the Executive Order, it should be emphasized that under California law (Title 22, Division 4, Chapter 30, Article 12), some hazardous wastes are considered recyclable. If these wastes are not recycled, the State Department of Health may request that the Air Force provide written justification for not having recycled the wastes.

Table 6 lists the recoverable hazardous wastes generated by Titan and Atlas operations at VAFB, and their acceptance by some of the major chemical reclamation companies in California. The economics of recycling contaminated solvents vary widely depending on the demand for the reclaimed product. For example, the Air Force would pay for any solvent reclaimed for its use. If, however, the reclaimer intends to sell the purified product, the Air Force might be paid for the waste, with the fee variable depending on the demand for the reclaimed solvent.

All cost figures presented in the original Space Shuttle report were based on wastes generated from 15 STS launches per year. Because of the revised shuttle launch schedule, the combined SD waste totals nowhere exceed those earlier estimates. Thus, it is not anticipated that the addition of Atlas, Titan, and CCF wastes to the STS waste load will create any new expenses or overburden planned facilities. Furthermore, treatment/storage/disposal facilities designed to handle the maximum STS waste load (even at 10 launches per year) should be able to accommodate the added SD wastes. The various programs overlap only in the early years of the STS program when the number of flights is fewer than 10 per year. The combined yearly totals seldom exceed the maximum STS waste load.

In addition, there are already transport, storage, treatment, and disposal arrangements for most of the existing Atlas, Titan, and CCF wastes. Many of these could be easily integrated into the STS waste management plan with no additional costs.

Areas of concern regarding SLC 3, SLC 4, and CCF wastes are as follows:

- Deluge water (SLC 4).
- Waste alcohol contaminated with hydrazine (SLC 4).

TABLE 5

COMPARATIVE BASELINE WASTE GENERATION FOR SD PROGRAMS BY TREATMENT CATEGORY (kg)

Trt Cat.	Program	1982	1983	1984	1985	1986	1987	1988	1989-1994 (per year)
1	Freon								
	STS (15 launches/yr)	0	0	0	9,510	14,266	23,776	35,664	35,664
	STS (10)	0	0	0	9,510	14,256	23,776	23,776	23,776
	TAC	0	0	0	0	0	0	0	0
2	Hypergolic Fuels/Fuel-Contaminated Water and Alcohol								
	STS (15)	0	0	0	20,243	30,364	50,607	75,910	75,910
	STS (10)	0	0	0	20,243	30,364	50,607	50,607	50,607
	TAC	5,948	14,372	5,948	11,397	0	0	0	0
3	Group I Hydrocarbons								
	STS (15)	0	0	0	2,063	3,094	5,157	7,735	7,735
	STS (10)	0	0	0	2,063	3,094	5,157	5,157	5,157
	TAC	1,694	1,694	1,694	1,694	1,694	847	847	847
5	Group II Hydrocarbons								
	STS (15)	0	0	0	23,584	44,122	58,962	88,443	88,443
	STS (10)	0	0	0	23,584	44,122	58,962	58,962	58,962
	TAC	7,892	7,892	7,892	8,745	8,745	5,652	5,652	2,560
8	Aqueous Solutions Contaminated with Metals								
	STS (15)	0	0	0	641	961	1,602	2,403	2,403
	STS (10)	0	0	0	641	961	1,602	1,602	1,602
	TAC	276,310	276,310	276,310	414,465	414,465	414,465	414,465	414,465
9	SRB Rinse Waters								
	STS (15)	0	0	0	991,969	1,487,953	2,479,922	3,719,383	3,719,383
	STS (10)	0	0	0	991,969	1,487,953	2,479,922	2,479,922	2,479,922
	TAC	0	0	0	0	0	0	0	0
10	Oxidizer/Acids, Bases								
	STS (15)	0	0	0	15,423,616	23,135,422	38,559,041	57,838,561	57,838,561
	STS (10)	0	0	0	15,423,616	23,135,422	38,559,041	38,559,041	38,559,041
	TAC	1,684,583	2,139,130	1,684,583	2,678,389	2,072,327	2,072,336	2,072,336	2,072,324
11	Fuel Vapor Scrubber Liquors								
	STS (15)	0	0	0	15,517	23,275	38,792	58,188	58,188
	STS (10)	0	0	0	15,517	23,275	38,792	38,792	38,792
	TAC	762	1,327	762	1,139	386	193	193	0
13	Combustible Solids								
	STS (15)	0	0	0	14,124	21,187	35,310	52,965	52,965
	STS (10)	0	0	0	14,124	21,187	35,310	35,310	35,310
	TAC	437	924	437	760	107	54	0	0
14	Noncombustible Solids								
	STS (15)	0	0	0	2,527	3,791	6,319	9,478	9,478
	STS (10)	0	0	0	2,527	3,791	6,319	6,319	6,319
	TAC	0	0	0	0	0	0	0	0

TABLE 6

SOLVENT RECLAIMING OPERATIONS IN CALIFORNIA

Solvent Reclaimer	Category 1	Category 2a		Category 3	Category 5					
	Freon	Hydrazine	MMI	Heptane	Perchloro-ethylene	Methylene Chloride	Cellusolve Acetate	Methy Ethyl Ketone	TCE/Freon Mixture	Misc. Solvent Mixtures
Baron-Blakeslee, Gardena	●				●	●			○	
Bayday Chemical Company, Santa Clara	●			○	○	●	○	○	○	○
Davis Chemical Company, Los Angeles	○			○	●	●	○	●	●	○
Environmental Recovery, Long Beach	○		●		●	●			○	○
Gold Shield Solvents, Los Angeles					●				●	
Oil and Solvents Process Company, Azusa	●			○	●	●	○	●	○	○
Zero Waste Systems, Oakland	●	○	○	○	●	●	○	○	○	○

◉ Reclaimer pays for waste.

⊙ Reclaimer takes waste for free or purifies it for reuse for a fee.

☐ Reclaimer does not accept waste.

- Metal finishing wastes containing chromium and cyanide (CCF).

At the present time, the CCF's metal finishing wastes are being treated and discharged to the sewer system, adding no new treatment burden to SD operations. However, it may be necessary to acquire RCRA treatment facility permits for the CCF; this could conceivably entail some upgrading of the CCF facilities.

The Titan deluge water is another area of concern. If the deluge water is deemed hazardous under RCRA, or if it exceeds NPDES standards and site hydrogeology indicates hydraulic continuity with the Lompoc aquifer, the simple discharge to grade will no longer be allowed. Under such circumstances, an engineered treatment/disposal system (i.e., evaporation basin, reverse osmosis, or ocean outfall) will be necessary over the remaining life of the Titan program.

Detailed deluge water analyses and hydrogeological studies are needed to establish whether a problem exists and how best to approach it. Deluge water could be piped to the evaporation basin at SLC 6; the appropriate piping installation would cost about $125,000 (1981 dollars). This does not alleviate the immediate problem, however, as the SLC 6 facility will not be operational until 1985, and the Titan launch program will end shortly thereafter. By comparison, the installation of simple gravity flow pipelines to ocean outfalls would cost about $12,000 at SLC 4.

An evaporation basin could be constructed at SLC 4. A simple 100,000-gallon basin with 60-cm freeboard, elastomeric membrane liner, and leachate collection system could be constructed for about $25,000 (1981 dollars). As a new facility, this basin would not be covered under existing permits.

It might also be possible to treat the water to a sufficient degree to discharge it to grade. A package treatment system, such as reverse osmosis, could be installed at the SLC for the duration of the planned launch activities. Reverse osmosis could provide a water of sufficient quality to be discharged to grade or to the ocean. A single reverse osmosis system, including pretreatment to remove particulates and scale-forming contaminants and to adjust pH, could be installed for $15,000 to $20,000. This system is known to remove any heavy metals and some organics; however, most of the organics are not removed.

Unlike evaporation basins, reverse osmosis has a significant annual operating and maintenance cost component, with estimates ranging from $3,200 to $7,200 per year. This includes power (20 kWh per 1,000 gallons) and labor (10 hours per month). In addition, special training is required to operate the system. At best, the system recovers 90 percent (by volume of the total wastewater quantity) of the good quality water; the remaining 10 percent or more consists of concentrated brine and sludge (from

pretreatment operations). Neither can be disposed of to grade or in the ocean. Thus, the brine and sludge would probably have to be drummed and transported to a suitable disposal facility elsewhere.

The waste alcohol contaminated with hydrazine from SLC 4 also adds a new disposal burden. Again, there is no comparable STS waste stream, and no waste management schemes were developed with this waste in mind. With land disposal in California soon to be prohibited, the remaining options include solvent recovery, incineration, or transport to an out-of-state disposal facility.

SECTION 2

INTRODUCTION

1. BACKGROUND

In July 1981, a report was prepared for the Department of the Air Force, HQ Space Division (DEV), which presented a projected hazardous waste inventory for the Space Transportation System (STS) at Vandenberg Air Force Base (VAFB) (1), and an assessment of the treatment and disposal options available for these wastes (2). A number of feasible treatment/disposal alternatives and their estimated costs were developed for the report.

The purpose of Volume I of this report is to present an inventory of hazardous wastes generated by the other Space Division (SD) facilities in a format compatible with the STS inventory. This volume presents an assessment of the potential effects of these additional wastes on the treatment/disposal options considered for the STS wastes, including the associated cost estimates.

The facilities covered in this report are the Atlas and Titan Launch Facilities (SLC 3 and SLC 4, respectively) and the Bionetics Component Cleaning Facility (CCF). Although the CCF is not an SD facility, it is included since a major portion of its work load involves SD systems (the percentage will increase substantially when the STS becomes fully operational at VAFB).

2. REPORT ORGANIZATION

In devising the STS hazardous waste inventory and evaluating management alternatives, it was necessary to group the wastes into a series of treatment categories. A treatment category essentially consists of all wastes of similar physical and chemical properties which can be treated or disposed of with the same technologies. From this classification, the different facilities and handling systems required by each group can be determined. All wastes within a group are compatible with each other, and each group's compatibility with wastes in other groups must be assessable in order to organize handling procedures. A discussion of hazardous waste grouping into treatment categories is provided in Section 3.

In the interim between the compilation of this inventory and the completion of the STS inventory and waste management assessment, there have been several changes in the laws and regulations

affecting hazardous waste management. One in particular, a State of California Executive Order (3, 4), will have an immediate impact on the planning for treatment/disposal facilities. The implications of this order for SD hazardous waste planning will be discussed more completely in Section 4.

Section 5 presents a detailed discussion of the technical and economic impacts of the additional SD wastes on those treatment and disposal alternatives considered for the STS program. For this discussion, it is assumed that these alternatives will be developed primarily for the STS; thus, any impacts caused by other SD activities will be evident only from 1985 on. That is, whereas the Atlas and Titan Launch Facilities and the CCF are currently operating and generating wastes, no STS hazardous wastes will be generated at VAFB until 1985. The current waste load is already covered under existing hazardous waste management plans which must be expanded to handle STS wastes.

The treatment/disposal/management schemes presented in Volume II of the STS inventory (2) were developed exclusively for STS wastes. The purpose of the discussion in Section 5 of this report is to determine whether the same schemes could be used to handle the combined SD waste streams within the economic framework developed in the STS report.

The cost estimates in the STS report were based on waste emissions from 15 STS launches per year. Subsequently, however, the maximum number of planned STS launches from VAFB has been reduced from 15 to 10 per year. Reducing the number of launches by one-third will have a sizable impact on many of the original STS waste cost estimates. However, it is not within the scope of this report to readjust those cost figures. Where new costs induced by added Titan and Atlas wastes are offset by reductions in STS wastes, this fact will be noted. Otherwise, the decrease in STS launches will not affect this discussion.

SECTION 3

TITAN, ATLAS, AND CCF HAZARDOUS WASTE CHARACTERIZATION

1. INTRODUCTION

An essential step in any discussion of treatment, reuse, and/or disposal of hazardous wastes from SD operations is the grouping of similar wastes into treatment categories. Many of these wastes are compatible in terms of their chemical and physical properties, and as such can be readily mixed and treated or disposed of together. These wastes then constitute a treatment category.

The procedure used to develop treatment categories for the Titan and Atlas hazardous wastes at VAFB was analogous to that used for the STS wastes. Namely, those categories already defined for Kennedy Space Center (KSC) (5) were used to the extent possible to facilitate comparisons between the two sites. The 15 treatment categories are as follows:

- Category 1: Recoverable Freon Wastes.
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- Category 4: Bilge Water and Water Contaminated with Oil.
- Category 5: Group II Hydrocarbon Wastes.
- Category 6: Recoverable Silver Wastes.
- Category 7: Recoverable Mercury Wastes.
- Category 8: Acids, Bases, and Aqueous Solutions Contaminated with Metal Ions.
- Category 9: Solid Rocket Booster (SRB) Rinse Waters.
- Category 10: Acidic and Basic Wastes Which Contain No Significant Metal Ions (Plus Oxidizer Wastes).
- Category 11: Fuel Vapor Scrubber Wastes.
- Category 12: Oxidizer Vapor Scrubber Wastes.

- Category 13: Combustible Solids.
- Category 14: Noncombustible Solids.
- Category 15: Miscellaneous Wastewaters.

Categories 6, 7, and 12 have no counterpart SD-VAFB waste, and thus are not used in this report.

2. WASTE GENERATION BY TREATMENT CATEGORIES

The treatment categories are described in more detail in Section 5. Table 7 presents a list of the Atlas, Titan, and CCF hazardous wastes by treatment category, showing the baseline quantities. Tables 8, 9, and 10 present summary annual waste generation rates by treatment category for SLC 3, SLC 4, and CCF, respectively. Table 11 gives the combined totals for all three facilities. It should be noted that Tables 8 through 11 only cover the period through 1988. Based on the launch schedule data provided to SCS, there will be no Titan and Atlas launches after 1988. The CCF waste quantities shown for 1987 and 1988 presumably will not change greatly through 1994.

TABLE 7. BASELINE WASTE GENERATION FOR TITAN AND ATLAS PROGRAMS BY TREATMENT CATEGORY*

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
2	SLC 4	HYDRAZINE	L	3.6	8.0	3.8	1.0
2	SLC 4	HYDRAZINE	L	.0	.0	.0	.0
2	SLC 4	HYDRAZINE/WATER WASTES	L	756.6	1668.0	757.0	200.0
2	SLC 4	HYDRAZINE/WATER WASTES	L	.0	.0	.0	.0
2	SLC 4	ISOPROPANOL	L	568.3	1253.0	726.7	192.0
2	SLC 4	ISOPROPANOL	L	623.2	1374.0	794.8	210.0
2	SLC 4	METHANOL	L	1004.2	2214.0	1271.8	336.0
2	SLC 4	UDMH	L	15.9	35.0	20.1	5.3
2	SLC 4	UDMH	L	2.4	5.2	3.0	.8
2	SLC 4	UDMH	L	.0	.0	.0	.0
TOTALS FOR TREATMENT CATEGORY 2							
ATLAS LAUNCHPADS - SLC3 (SVAFB)				.0	.0	.0	.0
TITAN LAUNCHPADS - SLC4 (SVAFB)				2974.3	6557.2	3577.2	945.1
COMPONENT CLEANING FACILITY (NVAFB)				.0	.0	.0	.0
3	SLC 3	OILS, USED	L	7.6	16.8	7.6	2.0
3	SLC 3	RP-1 SLUDGES	L	839.1	1850.0	832.7	220.0
TOTALS FOR TREATMENT CATEGORY 3							
ATLAS LAUNCHPADS - SLC3 (SVAFB)				846.8	1866.8	840.3	222.0
TITAN LAUNCHPADS - SLC4 (SVAFB)				.0	.0	.0	.0
COMPONENT CLEANING FACILITY (NVAFB)				.0	.0	.0	.0
5	SLC 3	METHYLETHYL KETONE (MEK)	L	6.1	13.4	7.6	2.0
5	SLC 3	TRICHLOROETHYLENE	L	3086.7	6805.0	2289.9	605.0
5	CCF	TRICHLOROETHANE (1,1,1,-)	L	1706.4	3762.0	1249.1	330.0
TOTALS FOR TREATMENT CATEGORY 5							
ATLAS LAUNCHPADS - SLC3 (SVAFB)				3092.8	6818.4	2297.5	607.0
TITAN LAUNCHPADS - SLC4 (SVAFB)				.0	.0	.0	.0
COMPONENT CLEANING FACILITY (NVAFB)				1706.4	3762.0	1249.1	330.0
8	CCF	CHROMIUM WASTEWATERS	L	138151.8	304574.3	138152.5	36500.0

* FOR SLC 3 AND SLC 4, QUANTITIES ARE GIVEN ON A PER LAUNCH BASIS; FOR CCF, AMOUNTS SHOWN ARE PER YEAR.

TABLE 7 (continued)

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
8	CCF	CYANIDE WASTEWATERS	L	138151.8	304574.3	138152.5	36500.0
TOTALS FOR TREATMENT CATEGORY 8							
	ATLAS LAUNCHPADS - SLC3 (SVAFB)			.0	.0	.0	.0
	TITAN LAUNCHPADS - SLC4 (SVAFB)			.0	.0	.0	.0
	COMPONENT CLEANING FACILITY (NVAFB)			276303.7	609148.6	276305.0	73000.0
10	SLC 4	DELUGE WATER	L	151499.1	334000.0	151400.0	40000.0
10	SLC 4	NITROGEN TETROXIDE	L	6.8	15.0	4.5	1.2
10	SLC 4	NITROGEN TETROXIDE	L	1.8	4.0	1.1	.3
10	SLC 4	NITROGEN TETROXIDE	L	4.4	9.6	3.0	.8
10	SLC 4	NITROGEN TETROXIDE	L	.0	.0	.0	.0
10	SLC 4	OXIDIZER/WATER WASTES	L	.0	.0	.0	.0
10	CCF	SODIUM HYDROXIDE WASTEWATER	L	1381518.3	3045742.5	1381525.0	365000.0
TOTALS FOR TREATMENT CATEGORY 10							
	ATLAS LAUNCHPADS - SLC3 (SVAFB)			.0	.0	.0	.0
	TITAN LAUNCHPADS - SLC4 (SVAFB)			151512.0	334028.6	151408.7	40002.3
	COMPONENT CLEANING FACILITY (NVAFB)			1381518.3	3045742.5	1381525.0	365000.0
11	SLC 3	HYDRAZINE SCRUBBER LIQUOR	L	192.9	425.3	193.0	51.0
11	SLC 4	HYDRAZINE SCRUBBER LIQUOR	L	188.2	415.0	189.3	50.0
TOTALS FOR TREATMENT CATEGORY 11							
	ATLAS LAUNCHPADS - SLC3 (SVAFB)			192.9	425.3	193.0	51.0
	TITAN LAUNCHPADS - SLC4 (SVAFB)			188.2	415.0	189.3	50.0
	COMPONENT CLEANING FACILITY (NVAFB)			.0	.0	.0	.0
13	SLC 3	RAGS, SOLVENT/OILY	S	53.4	117.8	68.0	2.4
13	SLC 4	RAGS, SOLVENT/OILY	S	163.3	360.0	209.5	7.4
TOTALS FOR TREATMENT CATEGORY 13							
	ATLAS LAUNCHPADS - SLC3 (SVAFB)			53.4	117.8	68.0	2.4
	TITAN LAUNCHPADS - SLC4 (SVAFB)			163.3	360.0	209.5	7.4
	COMPONENT CLEANING FACILITY (NVAFB)			.0	.0	.0	.0

TABLE 8. BASELINE WASTE GENERATION FOR ATLAS PROGRAMS BY TREATMENT CATEGORY

TREATMENT CATEGORY	1982		1983		1984		1985		1986		1987 & 88 (PER YR)	
	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	3733.6	444.0	3733.6	444.0	3733.6	444.0	3733.6	444.0	3733.6	444.0	1866.8	222.0
4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5	13636.8	1214.0	13636.8	1214.0	13636.8	1214.0	13636.8	1214.0	13636.8	1214.0	6818.4	607.0
8	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
11	850.6	102.0	850.6	102.0	850.6	102.0	850.6	102.0	850.6	102.0	425.3	51.0
13	235.6	4.8	235.6	4.8	235.6	4.8	235.6	4.8	235.6	4.8	117.8	2.4
14	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
15	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

TREATMENT CATEGORY DEFINITIONS:

1 = RECOVERABLE FREON WASTES
2 = HYPERGOLIC FUELS AND HYPERGOLIC FUEL-CONTAMINATED WATER AND ALCOHOL
3 = GROUP I HYDROCARBON WASTES
4 = BILGE WATER AND WATER CONTAMINATED WITH OIL
5 = GROUP II HYDROCARBON WASTES
8 = ACIDS, BASES, AND AQUEOUS SOLUTIONS CONTAMINATED WITH METAL IONS
9 = SOLID ROCKET BOOSTER RINSE WATER WASTES
10 = ACIDIC AND BASIC WASTES WHICH CONTAIN NO SIGNIFICANT METAL IONS (PLUS OXIDIZER WASTES)
11 = FUEL VAPOR SCRUBBER WASTES
13 = COMBUSTIBLE SOLIDS
14 = NONCOMBUSTIBLE SOLIDS
15 = MISCELLANEOUS WASTEWATERS

TABLE 9. BASELINE WASTE GENERATION FOR TITAN PROGRAMS BY TREATMENT CATEGORY

TREATMENT CATEGORY	1982		1983		1984		1985		1986		1987 & 88 (PER YR)	
	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	13114.4	1890.2	32786.0	4725.5	13114.4	1890.2	26228.8	3780.4	.0	.0	.0	.0
3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10	668057.3	80004.6	1670143.3	200011.5	668057.3	80004.6	1336114.5	160009.2	.0	.0	.0	.0
11	830.0	100.0	2075.0	250.0	830.0	100.0	1660.0	200.0	.0	.0	.0	.0
13	720.0	14.8	1800.0	37.0	720.0	14.8	1440.0	29.6	.0	.0	.0	.0
14	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
15	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

TREATMENT CATEGORY DEFINITIONS:

1 = RECOVERABLE FREON WASTES
2 = HYPERGOLIC FUELS AND HYPERGOLIC FUEL-CONTAMINATED WATER AND ALCOHOL
3 = GROUP I HYDROCARBON WASTES
4 = BILGE WATER AND WATER CONTAMINATED WITH OIL
5 = GROUP II HYDROCARBON WASTES
8 = ACIDS, BASES, AND AQUEOUS SOLUTIONS CONTAMINATED WITH METAL IONS
9 = SOLID ROCKET BOOSTER RINSE WATER WASTES
10 = ACIDIC AND BASIC WASTES WHICH CONTAIN NO SIGNIFICANT METAL IONS (PLUS OXIDIZER WASTES)
11 = FUEL VAPOR SCRUBBER WASTES
13 = COMBUSTIBLE SOLIDS
14 = NONCOMBUSTIBLE SOLIDS
15 = MISCELLANEOUS WASTEWATERS

TABLE 10. BASELINE WASTE GENERATION FOR CCF PROGRAMS BY TREATMENT CATEGORY

TREATMENT CATEGORY	1982		1983		1984		1985		1986		1987 & 88 (PER YR)	
	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5	3762.0	330.0	3762.0	330.0	3762.0	330.0	5643.0	495.0	5643.0	495.0	5643.0	495.0
8	609148.6	73000.0	609148.6	73000.0	609148.6	73000.0	913723.0	109500.0	913723.0	109500.0	913723.0	109500.0
9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10	3045742.5	365000.0	3045742.5	365000.0	3045742.5	365000.0	4568614.0	547500.0	4568614.0	547500.0	4568614.0	547500.0
11	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
13	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
14	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
15	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

TREATMENT CATEGORY DEFINITIONS:

1 = RECOVERABLE FREON WASTES
2 = HYPERGOLIC FUELS AND HYPERGOLIC FUEL-CONTAMINATED WATER AND ALCOHOL
3 = GROUP I HYDROCARBON WASTES
4 = BILGE WATER AND WATER CONTAMINATED WITH OIL
5 = GROUP II HYDROCARBON WASTES
8 = ACIDS, BASES, AND AQUEOUS SOLUTIONS CONTAMINATED WITH METAL IONS
9 = SOLID ROCKET BOOSTER RINSE WATER WASTES
10 = ACIDIC AND BASIC WASTES WHICH CONTAIN NO SIGNIFICANT METAL IONS (PLUS OXIDIZER WASTES)
11 = FUEL VAPOR SCRUBBER WASTES
13 = COMBUSTIBLE SOLIDS
14 = NONCOMBUSTIBLE SOLIDS
15 = MISCELLANEOUS WASTEWATERS

TABLE 11. BASELINE WASTE GENERATION FOR COMBINED TITAN, ATLAS, AND CCF PROGRAMS BY TREATMENT CATEGORY

TREATMENT CATEGORY	1982		1983		1984		1985		1986		1987 & 88 (PER YR)	
	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF	POUNDS	GALLONS OR CF
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	13114.4	1890.2	32786.0	4725.5	13114.4	1890.2	26228.8	3780.4	.0	.0	.0	.0
3	3733.6	444.0	3733.6	444.0	3733.6	444.0	3733.6	444.0	3733.6	444.0	1866.8	222.0
4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5	17398.8	1544.0	17398.8	1544.0	17398.8	1544.0	19279.8	1709.0	19279.8	1709.0	12461.4	1102.0
8	609148.6	73000.0	609148.6	73000.0	609148.6	73000.0	913723.0	109500.0	913723.0	109500.0	913723.0	109500.0
9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10	3713800.0	445004.6	4715886.0	565011.5	3713800.0	445004.6	5904729.0	707509.3	4568614.0	547500.0	4568614.0	547500.0
11	1680.6	202.0	2925.6	352.0	1680.6	202.0	2510.6	302.0	850.6	102.0	425.3	51.0
13	955.6	19.6	2035.6	41.8	955.6	19.6	1675.6	34.4	235.6	4.8	117.8	2.4
14	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
15	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

TREATMENT CATEGORY DEFINITIONS:

1 = RECOVERABLE FREON WASTES
2 = HYPERGOLIC FUELS AND HYPERGOLIC FUEL-CONTAMINATED WATER AND ALCOHOL
3 = GROUP I HYDROCARBON WASTES
4 = BILGE WATER AND WATER CONTAMINATED WITH OIL
5 = GROUP II HYDROCARBON WASTES
8 = ACIDS, BASES, AND AQUEOUS SOLUTIONS CONTAMINATED WITH METAL IONS
9 = SOLID ROCKET BOOSTER RINSE WATER WASTES
10 = ACIDIC AND BASIC WASTES WHICH CONTAIN NO SIGNIFICANT METAL IONS (PLUS OXIDIZER WASTES)
11 = FUEL VAPOR SCRUBBER WASTES
13 = COMBUSTIBLE SOLIDS
14 = NONCOMBUSTIBLE SOLIDS
15 = MISCELLANEOUS WASTEWATERS

SECTION 4

RECENT REGULATORY CONSTRAINTS

On October 13, 1981, the Governor of California signed an Executive Order designed to eliminate the land disposal of pesticides, PCB's, cyanides, toxic metal wastes, halogenated organics, and non-halogenated volatile organics (3). This Order was prompted by a report from the Office of Appropriate Technology (OAT) entitled, "Alternatives to the Land Disposal of Hazardous Wastes: An Assessment for California" (4).

Given the general descriptions of the waste streams covered by this Order, all of Categories 5 and 8 and parts of Categories 2, 3, and 11 from the Atlas/Titan/CCF will be affected. Within a few years (by the time the STS becomes operational at VAFB), land disposal of these wastes will be prohibited. In the interim, the State of California is considering imposing higher fees on the land disposal of these wastes until such time as the land disposal ban is implemented.

Suggested OAT landfill alternatives include waste reduction; waste recycling; physical, chemical, and biological treatment; high-temperature incineration; and solidification/stabilization. At the same time, OAT admits that these technologies have not been widely used in California, and more facilities will thus be needed to handle these wastes. Details on the implementation of the Executive Order are still forthcoming, and major changes, some of which could affect the SD wastes, are possible. However, the analysis presented in Section 5 is based on the assumption that land disposal in California will no longer be permitted for those wastes specified in the Executive Order. Out-of-state land disposal is still a possibility.

SECTION 5

IMPACTS OF TITAN, ATLAS, AND CCF WASTES ON STS HAZARDOUS WASTE MANAGEMENT

1. INTRODUCTION

In this section, each hazardous waste category will be discussed in terms of the contribution of wastes generated by the Atlas, Titan, and CCF facilities to the total SD waste load, and the concomitant impacts on treatment, recovery, and disposal options. Those management systems designed for the STS program will be evaluated to determine if they adequately meet any additional demands placed on them by other SD wastes. Again, it should be noted that the treatment systems discussed in the Space Shuttle report were based on a maximum of 15 launches per year, whereas the more recent projection is 10 launches per year.

Tables A-1 and A-2 (Appendix A) give a combined inventory of all SD wastes arranged by treatment category with a summary for each year of the program and the percent of the total waste load contributed by the Atlas, Titan, and CCF facilities. The summary table (A-2) is based on the new schedule of 10 launches per year. Table 12 presents a comparison of SD-generated wastes under both launch schedules.

In view of the Executive Order, it should be emphasized that under California law (Title 22, Division 4, Chapter 30, Article 12), some hazardous wastes are considered recyclable. If these wastes are not recycled, the State Department of Health may request that the Air Force provide written justification for not having recycled the wastes.

Table 13 lists some of the major chemical reclamation companies in California. The economics of recycling contaminated solvents vary widely depending on the demand for the reclaimed product. For example, the Air Force would pay for any solvent reclaimed for its use. If, however, the reclaimer intends to sell the purified product, the Air Force might be paid for the waste, with the fee variable depending on the demand for the reclaimed solvent. Values of such recoverable wastes are given in Table 14.

TABLE 12

COMPARATIVE BASELINE WASTE GENERATION FOR SD PROGRAMS
BY TREATMENT CATEGORY (kg)

Trt Cat.	Program	1982	1983	1984	1985	1986	1987	1988	1989-1994 (per year)
1	Freon								
	STS (15 launches/yr)	0	0	0	9,510	14,266	23,776	35,664	35,664
	STS (10)	0	0	0	9,510	14,266	23,776	23,776	23,776
	TAC	0	0	0	0	0	0	0	0
2	Hypergolic Fuels/Fuel-Contaminated Water and Alcohol								
	STS (15)	0	0	0	20,243	30,364	50,607	75,910	75,910
	STS (10)	0	0	0	20,243	30,364	50,607	50,607	50,607
	TAC	5,948	14,872	5,948	11,897	0	0	0	0
3	Group I Hydrocarbons								
	STS (15)	0	0	0	2,063	3,094	5,157	7,735	7,735
	STS (10)	0	0	0	2,063	3,094	5,157	5,157	5,157
	TAC	1,694	1,694	1,694	1,694	1,694	847	847	847
5	Group II Hydrocarbons								
	STS (15)	0	0	0	23,584	44,122	58,962	88,443	88,443
	STS (10)	0	0	0	23,584	44,122	58,962	58,962	58,962
	TAC	7,892	7,892	7,892	8,745	8,745	5,652	5,652	2,560
8	Aqueous Solutions Contaminated with Metals								
	STS (15)	0	0	0	641	961	1,602	2,403	2,403
	STS (10)	0	0	0	641	961	1,602	1,602	1,602
	TAC	276,310	276,310	276,310	414,465	414,465	414,465	414,465	414,465

TABLE 12 (continued)

Trt Cat.	Program	1982	1983	1984	1985	1986	1987	1988	1989-1994 (per year)
9	SRB Rinse Waters								
	STS (15)	0	0	0	991,969	1,487,953	2,479,922	3,719,883	3,719,883
	STS (10)	0	0	0	991,969	1,487,953	2,479,922	2,479,922	2,479,922
	TAC	0	0	0	0	0	0	0	0
10	Oxidizer/Acids, Bases								
	STS (15)	0	0	0	15,423,616	23,135,422	38,559,041	57,838,561	57,838,561
	STS (10)	0	0	0	15,423,616	23,135,422	38,559,041	38,559,041	38,559,041
	TAC	1,684,583	2,139,130	1,684,583	2,678,389	2,072,327	2,072,336	2,072,336	2,072,324
11	Fuel Vapor Scrubber Liquors								
	STS (15)	0	0	0	15,517	23,275	38,792	58,188	58,188
	STS (10)	0	0	0	15,517	23,275	38,792	38,792	38,792
	TAC	762	1,327	762	1,139	386	193	193	0
13	Combustible Solids								
	STS (15)	0	0	0	14,124	21,187	35,310	52,965	52,965
	STS (10)	0	0	0	14,124	21,187	35,310	35,310	35,310
	TAC	437	924	437	760	107	54	0	0
14	Noncombustible Solids								
	STS (15)	0	0	0	2,527	3,791	6,319	9,478	9,478
	STS (10)	0	0	0	2,527	3,791	6,319	6,319	6,319
	TAC	0	0	0	0	0	0	0	0

TABLE 13

SOLVENT RECLAIMING OPERATIONS IN CALIFORNIA

Solvent Reclaimer	Category 1	Category 2a		Category 3	Category 5					
	Freon	Hydrazine	MMH	Heptane	Perchloro-ethylene	Methylene Chloride	Cellusolve Acetate	Methy Ethyl Ketone	TCE/Freon Mixture	Misc. Solvent Mixtures
Baron-Blakeslee, Gardena	●				●	●			○	
Bayday Chemical Company, Santa Clara	●			○	○	●	○	○	○	○
Davis Chemical Company, Los Angeles	○			○	●	●	○	●	●	○
Environmental Recovery, Long Beach	○		●		●	●			○	○
Gold Shield Solvents, Los Angeles					●				●	
Oil and Solvents Process Company, Azusa	●			○	●	●	○	●	○	○
Zero Waste Systems, Oakland	●	○	○	○	●	●	○	○	○	○

● Reclaimer pays for waste.

○ Reclaimer takes waste for free or purifies it for reuse for a fee.

□ Reclaimer does not accept waste.

TABLE 14

VALUE OF RECOVERABLE WASTES

Waste Category	Waste Description	Reimbursement to Air Force for Sale of Waste Solvents ($ per gal received)*	Cost of Reclaiming Solvent for Air Force Reuse ($ per gal recovered)
I	Freon	0.50 to 1.25	5.00 to 6.00
V	Perchloroethylene	0.25 to 0.75	1.50 to 2.40
	Methylene Chloride	0.45 to 0.75	1.50 to 2.20
	Methyl Ethyl Ketone	0.10 to 0.25	1.50 to 2.20
	TCE/Freon Mixture	0.10 to 0.25	1.50 to 3.00

* Some commercial reclaimers reimburse in terms of recovered quantities rather than quantities received.

2. CATEGORY 1: FREON WASTES

The only identified source of waste freon from the Titan and Atlas facilities is SCAPE suit cleaning. Some freon is used for vapor degreasing, but this process generates no waste products. The amounts of freon wastes are negligible by comparison to the quantities generated by STS operations.

3. CATEGORY 2: HYPERGOLIC FUEL WASTES AND HYPERGOLIC FUEL-CONTAMINATED WATER AND ALCOHOL

For the purposes of treatment and disposal evaluations, this category can be divided into two subcategories: (a) fuel wastes, and (b) wastewaters/alcohols contaminated with hypergolic fuels.

The only year in which all SD facilities can be expected to generate wastes is 1985. In this year, 41 percent (by volume) of the wastes will be generated from SLC 4. However, because of increasing numbers of STS launches per year, the SD Category 2 waste load is expected to increase by over 50 percent after the Titan launches cease.

Over 99 percent of the Titan Category 2 waste is Category 2b; 75 percent of this is alcohol-based, whereas most of the STS 2b wastes are water-based. The types of physical/chemical treatments under consideration for fuel-contaminated water at VAFB will be inadequate to handle the alcohol wastes. Since land disposal in California has been ruled out, only incineration, solvent recovery, and out-of-state land disposal are available as options. The impact of these wastes on storage/transfer and incineration facilities will be discussed later.

4. CATEGORY 3: GROUP I HYDROCARBON WASTES

Category 3 includes petroleum-based lubricants, greases, motor oils, gasoline, and fuels from equipment maintenance and spills, and Group I hydrocarbon solvents (i.e., unsubstituted solvents such as heptane). In 1985, wastes from SLC 3 will constitute almost 50 percent of the SD Category 3 waste load. This will decrease to about one-third in 1986, one-seventh in 1987 and 1988, and none thereafter. Most of the STS Category 3 wastes are recyclable; 99 percent of the SLC 3 wastes are not. The major component of the SLC 3 Category 3 wastes is sludge from the Atlas RP-1 fuel tanks. Again, land disposal will probably not be permitted in California. Incineration is the most likely alternative.

5. CATEGORY 4: BILGE WASTES

No bilge wastes are produced at SLC 3, SLC 4, or CCF.

6. CATEGORY 5: GROUP II HYDROCARBON WASTES

Category 5 includes halogenated hydrocarbon solvents, cleaning solvents, paints and paint wastes, paint strippers, etc. SLC 3 will produce Category 5 wastes through 1988, and the CCF will generate these wastes through 1994. Approximately 95 percent (by volume) of these wastes are solvents, and are thus considered recyclable. The other viable option is incineration. Since the combined Category 5 waste totals of SLC 3, CCF, and STS (the latter at 10 launches per year) never exceed the totals presented in the first STS inventory (based on 15 launches per year), the additional wastes are not expected to have any noticeable impact on the management of Category 5 wastes.

7. CATEGORY 8: ACIDS, BASES, AND AQUEOUS SOLUTIONS CONTAMINATED WITH METAL IONS

The CCF produces over 99 percent of all SD Category 8 wastes. These consist of metal finishing wastewaters containing chromium and cyanide. The CCF is currently treating these wastes in-house, and discharging the treated wastewaters to the sewer system. Because of ambiguities in the hazardous waste regulations, there is some uncertainty as to whether these wastewaters should be considered hazardous wastes or industrial wastewater discharges covered under existing wastewater regulations. An EPA ruling will be required for clarification. It is possible that the CCF will need an RCRA permit to operate as a hazardous waste treatment facility, in which case it will be required to meet the appropriate regulations. In any case, as long as the CCF treats its own Category 8 wastewaters, these wastes will not affect the SD waste management plans.

8. CATEGORY 9: SRB RINSE WATERS

No SRB rinse waters are generated at SLC 3, SLC 4, or CCF.

9. CATEGORY 10: ACID AND BASE SOLUTIONS NOT CONTAMINATED WITH METAL IONS

Category 10 includes general acid and base wastewaters low in organics and metals. This includes waste oxidizer and wastewaters containing oxidizer. For treatment and disposal purposes, it is helpful to divide the category into three subcategories: (a) waste oxidizer; (b) wastewaters containing oxidizer; and (c) general acid/base wastewaters, including deluge waters. SLC 3, SLC 4, and CCF do not contribute a significant portion of the total Category 10 wastes. However, almost all of the Category 10 wastes consist of SLC 4 deluge water and caustic wastewaters from CCF. The deluge water at SLC 3 has been shown to be nonhazardous through detailed chemical analyses (see Volume 1). Consequently, it is excluded from all discussions in this volume. At the present time, the deluge water is being discharged to grade, and the caustic wastewaters are neutralized and discharged to the sewer system. Thus, at present, they do not directly impact the treatment/disposal alternatives under consideration for the STS.

However, the deluge water may pose new treatment/disposal problems. There is some question as to whether the discharge of the deluge water to grade is permissible. SLC 4 overlies a geologic area conterminous with the principal Lompoc ground water supply aquifer. Without further geologic and soils testing, however, it is impossible to determine whether the SLC is in hydraulic continuity with the aquifer, or to what degree the deluge water migrates through the soil rather than evaporates. Also, without detailed analyses of the deluge water, it is impossible to determine whether it even constitutes a threat to the aquifer. If the water contains no toxic or hazardous pollutants, then they pose no problem. In the absence of more complete knowledge of the hydrogeology or chemical composition of the deluge water, it might be necessary to install regularly lined and bermed evaporation basins below the SLC. Another possibility, if the water meets NPDES standards, is ocean discharge.

This problem can be resolved by conducting (1) a complete chemical characterization of the deluge water, and (2) extensive hydrogeological testing. There are several potential options available for the treatment/disposal of the wastewater; selection among them will largely be based on a number of regulatory constraints which may or may not be applicable, depending on the chemical makeup of the deluge water. The deluge water cannot be disposed of in such a way as to degrade the quality of a water supply aquifer by contaminating it with toxic materials, or adversely affect the natural ocean environment. Thus, a graded selection of disposal options exists, with selection controlled by the character of the wastewater. If no contaminants are found in the water, continued disposal to grade may be justifiable. Low levels of contamination could preclude uncontrolled surface discharge, but slow-release ocean discharge might still be acceptable. Higher levels of contamination would dictate either waste treatment or hydrogeologically isolated disposal facilities.

Disposal site hydrogeology plays another important role. If it can be established through extensive hydrogeological testing that the disposal site is not in hydraulic continuity with the aquifer and that past wastewater disposal has not affected water quality, then continued discharge to grade might be acceptable, even if moderately contaminated. This is a distinct possibility in view of the projected cessation of launch activities at SLC 4 in the near future. A short-term variance might be granted, although not without some stipulation for sophisticated monitoring.

If the wastewater quality or site hydrogeology preclude simple discharge, several treatment/disposal options exist. The deluge water could be piped to the evaporation basin at SLC 6. The appropriate piping installation would cost about $125,000 (1981 dollars). This does not alleviate the immediate problem, however, as the SLC 6 facility will not be operational until 1985, and the Titan and Atlas launch programs will end shortly

thereafter. By comparison, the installation of simple gravity flow pipelines to ocean outfalls would cost about $12,000 at SLC 4.

An evaporation basin could be constructed at the SLC. A simple 100,000-gallon basin with 60-cm freeboard, elastomeric membrane liner, and leachate collection system could be constructed for about $25,000 (1981 dollars). As a new facility, this basin would not be covered under existing permits.

It might also be possible to treat the water to a sufficient degree to discharge it to grade. A package treatment system, such as reverse osmosis, could be installed at each SLC for the duration of the planned launch activities. Reverse osmosis could provide a water of sufficient quality to be discharged to grade or to the ocean. A single reverse osmosis system, including pretreatment to remove particulates and scale-forming contaminants and to adjust pH, could be installed for $15,000 to $20,000. This system is known to remove any heavy metals and some organics; however, most of the organics are not removed. Unlike evaporation basins, reverse osmosis has a significant annual operating and maintenance cost component, with estimates ranging from $3,200 to $7,200 per year. This includes power (20 kWh per 1,000 gallons) and labor (10 hours per month). In addition, special training is required to operate the system. At best, the system recovers 90 percent (by volume of the total wastewater quantity) of the good quality water; the remaining 10 percent or more consists of concentrated brine and sludge (from pretreatment operations). Neither can be disposed of to grade or in the ocean. Thus, the brine and sludge would probably have to be drummed and transported to a suitable disposal facility elsewhere.

10. CATEGORY 11: FUEL VAPOR SCRUBBER WASTES

Category 11 includes effluent from hypergolic fuel vapor scrubbers. Both SLC 3 and SLC 4 have scrubbers. The scrubber at SLC 4 contains 50 gallons of water and 1 gallon of 38 percent HCl (pH <1). The chemical treatment method suggested for STS Category 11 wastes should be equally effective with the SLC wastes. Furthermore, the additional quantity (less than 10 percent of the total) should place no burdens on the system described therein (see Table 24, Space Shuttle report) (2). The only additional cost would be that for transporting the waste (one 55-gallon drum per launch per SLC) to the treatment facility.

11. CATEGORY 13: COMBUSTIBLE SOLID WASTES

Operations at both SLC's generate small quantities of rags soaked in solvents or oils. They do not contribute greatly to the overall Category 13 waste load (only 5 percent in 1985, and less thereafter). Thus, their impact is expected to be negligible.

12. CATEGORIES 14 AND 15: NONCOMBUSTIBLE SOLID WASTES AND MISCELLANEOUS WASTEWATERS

Wastes from these categories are not generated at SLC 3 or SLC 4. Empty chemical containers from the CCF (e.g., those holding acutely hazardous material such as cyanides) would have to be considered hazardous if they were not triple-rinsed with an appropriate solvent.

13. CONCLUSIONS

All cost figures presented in the original Space Shuttle report were based on wastes generated from 15 STS launches per year. Because of the revised shuttle launch schedule, the combined SD waste totals nowhere exceed those earlier estimates. Thus, it is not anticipated that the addition of Atlas, Titan, and CCF wastes to the STS waste load will create any new expenses or overburden planned facilities. Furthermore, treatment/storage/disposal facilities designed to handle the maximum STS waste load (even at 10 launches per year) should be able to accommodate the added SD wastes. The various programs overlap only in the early years of the STS program when the number of flights is fewer than 10 per year. The combined yearly totals seldom exceed the maximum STS waste load.

In addition, there are already transport, storage, treatment, and disposal arrangements for most of the existing Atlas, Titan, and CCF wastes. Many of these could be easily integrated into the STS waste management plan with no additional costs.

There are only a few areas of concern in regard to Titan, Atlas, and CCF wastes. The CCF produces several wastewaters which have no counterpart in the STS program, i.e., metal finishing wastewaters containing chromium and cyanide (Category 8). At the present time, these are being treated and discharged to the sewer system, adding no new treatment burden to SD operations. However, it may be necessary to acquire RCRA treatment facility permits for the CCF; this could conceivably entail some upgrading of the CCF facilities.

The Titan deluge water is another area of concern. If the deluge water is deemed hazardous under RCRA, or if it exceeds NPDES standards and site hydrogeology indicates hydraulic continuity with the Lompoc aquifer, the simple discharge to grade will no longer be allowed. Under such circumstances, an engineered disposal system (e.g., evaporation basin, ocean outfall) or treatment system (e.g., reverse osmosis) will be necessary over the remaining life of the Titan program. Detailed deluge water analyses and hydrogeological studies are needed to establish whether a problem exists and how best to approach it.

The waste alcohol contaminated with hydrazine from SLC 4 also adds a new disposal burden. Again, there is no comparable STS waste stream, and no waste management schemes were developed

with this waste in mind. With land disposal in California soon to be prohibited, the remaining options include solvent recovery, incineration, or transport to an out-of-state disposal facility.

REFERENCES

1. SCS Engineers. Hazardous Waste Inventory and Disposal Assessment for the Space Shuttle Project: Volume I. Inventory. SD-TR-81-32, March 1981.

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3. Executive Order. Executive Department, State of California, October 13, 1981.

4. State of California, Toxic Waste Assessment Group, Governor's Office of Appropriate Technology. Alternatives to the Land Disposal of Hazardous Wastes: An Assessment for California. Sacramento, California, 1981.

5. Russell and Axon. Chemical Waste Disposal Facilities Preliminary Engineering Report. PCN 77851. National Aeronautics and Space Administration, Florida, October 1977.

APPENDIX A

COMBINED SD HAZARDOUS WASTE INVENTORY ARRANGED BY TREATMENT CATEGORY

TABLE A-1. BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY * PAGE 1

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
1	0	CONTAMINATED FREON	L	2376.8	5240.0	1514.0	400.0
1	31	FREON 113	L	.6	1.3	.4	.1
1	99	FREON TMC	L	.1	.3	.0	.0
TOTALS FOR TREATMENT CATEGORY 1							
		ATLAS LAUNCH FACILITIES (SLC 3)		.0	.0	.0	.0
		TITAN LAUNCH FACILITIES (SLC 4)		.0	.0	.0	.0
		COMPONENT CLEANING FACILITY		.0	.0	.0	.0
		STS NORTH VAFB (SS 17,18,19,21)		2376.8	5240.0	1514.0	400.0
		STS SOUTH VAFB (SS 23,31,33,99)		.7	1.6	.4	.1
		STS PORT HUENEME (SS 32)		.0	.0	.0	.0
2	SLC 4	HYDRAZINE	L	3.6	8.0	3.8	1.0
2	SLC 4	HYDRAZINE	L	.0	.0	.0	.0
2	SLC 4	HYDRAZINE/WATER WASTES	L	756.6	1668.0	757.0	200.0
2	SLC 4	HYDRAZINE/WATER WASTES	L	.0	.0	.0	.0
2	SLC 4	ISOPROPANOL	L	568.3	1253.0	726.7	192.0
2	SLC 4	ISOPROPANOL	L	623.2	1374.0	794.8	210.0
2	SLC 4	METHANOL	L	1004.2	2214.0	1271.8	336.0
2	SLC 4	UDMH	L	15.9	35.0	20.1	5.3
2	SLC 4	UDMH	L	2.4	5.2	3.0	.8
2	SLC 4	UDMH	L	.0	.0	.0	.0
2	17	CONTAMINATED DILUTION WATER MMH	L	.0	.0	.0	.0
2	19	HYDRAZINE	L	.0	.0	.0	.0
2	19	HYDRAZINE	L	68.0	150.0	68.1	18.0
2	19	WASTEWATER FROM PAYLOAD/ORB	L	544.3	1200.0	567.8	150.0
		MMH		54.4	120.0	56.8	15.0
2	19	WASTE FUEL AND PRIMOL 355	L	36.3	80.0	37.8	10.0
		HYDRAZINE		1.8	4.0	1.9	.5
		MMH					

* FOR SLC3, SLC4 & STS QUANTITIES ARE GIVEN ON A PER LAUNCH BASIS; FOR CCF, AMOUNTS SHOWN ARE PER YEAR.

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 2

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
2	19	MONOMETHYL HYDRAZINE	L	35.4	78.0	40.5	10.7
2	19	MONOMETHYL HYDRAZINE	L	9.1	20.0	10.2	2.7
2	19	MONOMETHYL HYDRAZINE	L	18.8	41.4	21.6	5.7
2	19	MONOMETHYL HYDRAZINE	L	18.8	41.4	21.6	5.7
2	19	MONOMETHYL HYDRAZINE	L	13.3	29.4	15.1	4.0
2	19	MONOMETHYL HYDRAZINE	L	41.6	91.8	47.7	12.6
2	21	WASTEWATER WITH MMH MMH	L	108.0 10.0	238.0 22.0	113.6 11.4	30.0 3.0
2	21	MONOMETHYL HYDRAZINE	L	.0	.0	.0	.0
2	23	HYDRAZINE	L	208.2	459.0	189.3	50.0
2	23	HYDRAZINE	L	.0	.0	.0	.0
2	23	HYDRAZINE-CONTAM. WASTEWATER HYDRAZINE	L	567.9 28.1	1252.0 62.0	567.8 1.1	150.0 .3
2	23	HYDRAZINE-CONTAM. CLNUP WATER HYDRAZINE	L	189.1 2.1	417.0 4.6	189.3 1.9	50.0 .5
2	23	WASTEWATER FROM PPR HYDRAZINE	L	2271.1	5007.0	2271.0	600.0
2	23	PRIMOL 355 HYDRAZINE MMH	L	340.6	751.0	378.5	100.0
2	23	MONOMETHYL HYDRAZINE	L	330.7	729.0	378.5	100.0
2	23	MONOMETHYL HYDRAZINE	L	.0	.0	.0	.0
2	23	LBM PROPELLANT PARAHYDRAZINE UNSYM DIMETHYLHYDRAZINE	L	.0	.0	.0	.0
2	31	HYDRAZINE	L	109.5	241.3	109.0	28.8
2	31	PRIMOL 355	L	.0	.0	.0	.0
2	32	HYDRAZINE	L	41.0	90.5	40.9	10.8
2	32	HYDRAZINE-CONTAMINATED WATER	L	108.9	240.0	113.6	30.0

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 3

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
2	32	WASTE FUEL & PRIMOL 355 HYDRAZINE	L	.0	.0	.0	.0
TOTALS FOR TREATMENT CATEGORY 2							
	ATLAS LAUNCH FACILITIES (SLC 3)			.0	.0	.0	.0
	TITAN LAUNCH FACILITIES (SLC 4)			2974.3	6557.2	3577.2	945.1
	COMPONENT CLEANING FACILITY			.0	.0	.0	.0
	STS NORTH VAFB (SS 17,18,19,21)			893.6	1970.0	944.0	249.4
	STS SOUTH VAFB (SS 23,31,33,99)			4017.1	8856.3	4083.3	1078.8
	STS PORT HUENEME (SS 32)			149.9	330.5	154.4	40.8
3	SLC 3	OILS, USED	L	7.6	16.8	7.6	2.0
3	SLC 3	RP-1 SLUDGES	L	839.1	1850.0	832.7	220.0
3	17	FUEL, DIESEL	L	.0	.0	.0	.0
3	17	FUEL, DIESEL & OIL, DIESEL	L	.0	.0	.0	.0
3	18	HYDRAULIC FLUIDS	L	4.3	9.5	9.5	2.5
3	19	VACUUM PUMP OIL TEXACO REGAL OIL 068	L	4.5	10.0	4.5	1.2
3	23	HYDRAULIC FLUIDS TETRAORTHOCRESOL PHOSPHATE	L	393.7 393.7	868.0 868.0	378.5 378.5	100.0 100.0
3	31	FUEL AND OIL SPILLS	L	.0	.0	.0	.0
3	31	FUEL & OIL WASTES	L	38.1	84.0	37.8	10.0
3	32	PRESERVATIVE CHEMICALS PROTECTIVE LUBRICANTS	L	.0	.0	.0	.0
3	32	DIESEL FUEL & OIL SPILLS	L	.0	.0	.0	.0
3	33	HYDRAULIC FLUIDS	L	.0	.0	.0	.0
3	99	HEPTANE	L	75.1	165.5	113.2	29.9
TOTALS FOR TREATMENT CATEGORY 3							
	ATLAS LAUNCH FACILITIES (SLC 3)			846.8	1866.8	840.3	222.0
	TITAN LAUNCH FACILITIES (SLC 4)			.0	.0	.0	.0
	COMPONENT CLEANING FACILITY-			.0	.0	.0	.0
	STS NORTH VAFB (SS 17,18,19,21)			8.8	19.5	14.0	3.7
	STS SOUTH VAFB (SS 23,31,33,99)			506.9	1117.5	529.5	139.9
	STS PORT HUENEME (SS 32)			.0	.0	.0	.0

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 4

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
4	32	BILGE WASTES	L	.0	.0	.0	.0
TOTALS FOR TREATMENT CATEGORY 4							
		ATLAS LAUNCH FACILITIES (SLC 3)		.0	.0	.0	.0
		TITAN LAUNCH FACILITIES (SLC 4)		.0	.0	.0	.0
		COMPONENT CLEANING FACILITY		.0	.0	.0	.0
		STS NORTH VAFB (SS 17,18,19,21)		.0	.0	.0	.0
		STS SOUTH VAFB (SS 23,31,33,99)		.0	.0	.0	.0
		STS PORT HUENEME (SS 32)		.0	.0	.0	.0
5	SLC 3	METHYLETHYL KETONE (MEK)	L	6.1	13.4	7.6	2.0
5	SLC 3	TRICHLOROETHYLENE	L	3086.7	6805.0	2289.9	605.0
5	CCF	TRICHLOROETHANE (1,1,1,-)	L	1706.4	3762.0	1249.1	330.0
5	19	EA 911 EPOXY	L	.0	.0	.0	.0
		EPOXY					
		ZINC CHROMATE					
		ASBESTOS					
		MERCAPTAN					
		DIMETHYLAMINE					
5	19	EA 934 EPOXY	L	.0	.0	.0	.0
		EPOXY RESIN					
		ASBESTOS					
5	19	EA 9309 EPOXY	L	.0	.0	.0	.0
		EPOXY RESIN					
		GLASS FIBERS					
		ACRYLONITRILE/BUTADIEN/STYRENE					
		ASBESTOS					
		POLYGLYCOL DIAMINE					
		SILANE					
5	19	DOPE & LACQUER THINNER	L	.8	1.8	.8	.2
		ALIPHATIC NAPTHA		.1	.3		
		ESTER OR KETONE		.4	.8		
		ISO- OR n-BUTYL ACETATE		.2	.5		
		ISO- OR n-BUTYL ALCOHOL		.1	.2		
5	19	LACQUER #626486	L	.6	1.3	.8	.2
5	19	ORGANIC ZINC PRIMER	L	5.7	12.5	5.7	1.5
		ZINC DUST					
		BARYTES					
		MOLYBDATE ORANGE					

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
		SILICA					
		HIGH MOLECULAR WEIGHT EPOXY					
		CELLOSOLVE ACETATE					
		TOLUENE					
		METHYL ETHYL KETONE					
5	23	SOLVENT MIXTURE	L	291.5	642.6	208.2	55.0
		FREON TMC/MF/TF					
		SYM. TETRACHLOROETHANE					
5	23	CONTAMINATED SOLVENTS	L	264.9	584.0	189.3	50.0
5	31	MSA-1, PART A (UNMIXED)	L	.0	.0	.0	.0
		METHYLENE CHLORIDE					
		EPICHLORHYDRIN/BGE					
5	31	MSA-1, PART B (UNMIXED)	L	.0	.0	.0	.0
		METHYLENE CHLORIDE					
		PERCHLOROETHYLENE					
		METHYLENE DIANILINE					
		m-PHENYLENE DIAMINE					
		ETHYL ALCOHOL					
		PHENOLIC MICROSPHERES					
		GLASS ECOSPHERES					
		GLASS FIBERS					
		BENTONE 27					
5	31	MTA-2 (UNMIXED)	L	13.6	30.0	151.4	40.0
		EPICHLORHYDRIN/BGE		4.2	9.3		
		LP-3, POLYSULFIDE LIQ POLYMER		4.2	9.3		
		MDA & mPDA		1.7	3.7		
		STANNOUS OCTOATE		.2	.4		
		PHENOLIC MICROSPHERES		3.4	7.4		
		METHYLENE CHLORIDE					
		PERCHLOROETHYLENE					
5	31	MSA-1 CONTAMINATED MECl	L	1505.5	3319.0	1135.5	300.0
5	31	METHYLENE CHLORIDE	L	255.8	564.0	193.0	51.0
5	31	BOSTIK EPOXY PRIMER	L	12.2	27.0	11.4	3.0
		EPOXY RESIN		1.6	3.5		
		AMINE CURING AGENT		.3	.6		
		TITANIUM DIOXIDE		.3	.6		
		CHROMATE PIGMENTS		.5	1.2		
		INERT PIGMENTS		1.7	3.8		
		SUSPENSION & FLOW CONTROL ADDI		.0	.1		
		SOLVENTS		7.3	16.2		
5	31	BOSTIK EPOXY TOPCOAT	L	16.8	37.0	15.1	4.0

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 6

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
		EPICHLORHYDRIN/BISPHENOL A		4.1	9.0		
		AMINE CURING AGENT		.6	1.4		
		COLOR PIGMENT		3.4	7.5		
		SUSPENSION & FLOW CONTROL ADDI		.2	.5		
		SOLVENTS PHOTOCHEM REACTIVE		1.6	3.5		
		SOLVENTS NONPHOTOCHEM REACTIVE		6.8	15.0		
5	31	RUSTOLEUM PRIMER	L	3.6	8.0	3.8	1.0
		SILICATES		.6	1.3		
		YELLOW IRON OXIDE		.3	.6		
		TITANIUM DIOXIDE		.1	.2		
		CALCIUM BOROSILICATE		.7	1.5		
		BENTONITE					
		LINSEED PHENOLIC ALKYL RESIN		.7	1.6		
		ALIPHATIC HYDROCARBONS		1.2	2.6		
		DRIERS AND ADDITIVES		.1	.2		
5	31	RUSTOLEUM TOPCOAT	L	3.6	8.0	3.8	1.0
		SILICATES		1.2	2.6		
		TITANIUM DIOXIDE		.6	1.4		
		BENTONITE CLAY					
		TINTING COLORS		.1	.2		
		ALKYL RESIN		.6	1.4		
		ALIPHATIC HYDROCARBONS		1.1	2.4		
		DRIERS & ADDOTIVES		.0	.1		
5	31	GACOFLEX	L	17.7	39.0	11.4	3.0
		TITANIUM DIOXIDE		1.2	2.7		
		CLAY		1.4	3.1		
		HYPALON		1.8	3.9		
		HYDROCARBON RESIN		.4	.8		
		PERCHLOROETHYLENE		8.3	18.3		
		1,1,1-TRICHLOROETHANE		4.4	9.8		
		EPOXIDIZED SOYBEAN OIL		.2	.4		
5	31	PAINT-SPILL ABSORBANT	L	.0	.0	.0	.0
5	31	PERCHLOROETHYLENE	L	.6	1.4	.4	.1
5	31	MSA-1 CONTAM PERCHLOROETHYLENE	L	1852.0	4083.0	1135.5	300.0
5	31	PERCHLOROETHYLENE	L	277.6	612.0	170.3	45.0
5	31	MTA-2 CONTAMINATED SOLVENTS	L	529.8	1168.0	378.5	100.0
5	31	BOSTIK CONTAMINATED SOLVENTS	L	264.9	584.0	189.3	50.0
5	31	RUSTOLEUM CONTAMINATED SOLVENT	L	264.9	584.0	189.3	50.0
5	31	TRICHLOROETHANE	L	.5	1.1	.4	.1

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
5	31	TRICHLOROETHANE	L	81.6	180.0	60.6	16.0
5	32	SOLVENTS	L	10.6	23.4	7.6	2.0
		FREON TMC/TM					
		SOLVENTS, UNSPECIFIED					
5	99	CELLOSOLVE ACETATE	L	107.0	236.0	113.2	29.9
5	99	POUR FOAM PART A (UNMIXED)	L	6.4	14.0	18.9	5.0
		DIPHENYL METHANE DIISOCYANATE		3.2	7.0		
		FREON 11		2.0	4.5		
		POLYOLS, AMINES		1.1	2.5		
5	99	POUR FOAM PART B (UNMIXED)	L	6.4	14.0	18.9	5.0
		FREON 11		1.3	2.8		
		AMINE CATALYST		.1	.3		
		POLYETHER POLYOL BLEND		4.9	10.9		
5	99	METHYL ETHYL KETONE	L	88.4	194.9	109.8	29.0
5	99	EPOXY PRIMER	L	.0	.1	.0	.0
		METHYLENE ISOBUTYL KETONE					
		XYLENE					
		CYCLOHEXANONE					
		CHROMATES					
		INORGANIC PIGMENTS					
		N-BUTANOL					
		TOLUENE					
		AMINO SILANE					
		METHYL ETHYL KETONE					
5	99	D.C. 1200	L	.0	.1	.0	.0
		VM AND P NAPTHA					
		ORGANOMETALLIC SALTS					
5	99	SOLVENT REDUCER	L	.5	1.2	.4	.1
		METHYL ETHYL KETONE		.4	.8		
		CYCLOHEXANONE		.2	.4		
5	99	MEK & CELLOSOLVE	L	12.2	26.9	15.1	4.0
5	99	1,1,1-TRICHLOROETHANE	L	.1	.3	.0	.0
TOTALS FOR TREATMENT CATEGORY 5							
ATLAS LAUNCH FACILITIES (SLC 3)				3092.8	6818.4	2297.5	607.0
TITAN LAUNCH FACILITIES (SLC 4)				.0	.0	.0	.0
COMPONENT CLEANING FACILITY				1706.4	3762.0	1249.1	330.0
STS NORTH VAFB (SS 17,18,19,21)				7.1	15.6	7.2	1.9
STS SOUTH VAFB (SS 23,31,33,99)				5878.3	12959.6	4323.2	1142.2
STS PORT HUENEME (SS 32)				10.6	23.4	7.6	2.0

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 8

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
8	CCF	CHROMIUM WASTEWATERS	L	138151.8	304574.3	138152.5	36500.0
8	CCF	CYANIDE WASTEWATERS	L	138151.8	304574.3	138152.5	36500.0
8	31	ALODINE CONTAMINATED WASTEWATR	L	151.5	334.0	151.4	40.0
		CHROMIC ACID		2.7	5.9		
		FERRICYANIDE SALT		1.5	3.3		
		COMPLEX FLUORIDE SALT		.0	.1		
8	32	POTASSIUM HYDROXIDE SOLUTION	L	8.7	19.2	8.7	2.3
TOTALS FOR TREATMENT CATEGORY 8							
		ATLAS LAUNCH FACILITIES (SLC 3)		.0	.0	.0	.0
		TITAN LAUNCH FACILITIES (SLC 4)		.0	.0	.0	.0
		COMPONENT CLEANING FACILITY		276303.7	609148.6	276305.0	73000.0
		STS NORTH VAFB (SS 17,18,19,21)		.0	.0	.0	.0
		STS SOUTH VAFB (SS 23,31,33,99)		151.5	334.0	151.4	40.0
		STS PORT HUENEME (SS 32)		8.7	19.2	8.7	2.3
9	32	CONTAMINATED SEAWATER	L	.0	.0	.0	.0
9	32	CONTAMINATED SEAWATER	L	14514.9	32000.0	15140.0	4000.0
9	32	SRB RINSE WATER	L	21772.3	48000.0	22710.0	6000.0
9	32	POTABLE RINSE WATER	L	120473.5	265600.0	125662.0	33200.0
9	32	DEIONIZED RINSE WATER	L	56390.3	124320.0	58818.9	15540.0
9	32	DETERGENT WASHWATER	L	34835.7	76800.0	36336.0	9600.0
TOTALS FOR TREATMENT CATEGORY 9							
		ATLAS LAUNCH FACILITIES (SLC 3)		.0	.0	.0	.0
		TITAN LAUNCH FACILITIES (SLC 4)		.0	.0	.0	.0
		COMPONENT CLEANING FACILITY		.0	.0	.0	.0
		STS NORTH VAFB (SS 17,18,19,21)		.0	.0	.0	.0
		STS SOUTH VAFB (SS 23,31,33,99)		.0	.0	.0	.0
		STS PORT HUENEME (SS 32)		247986.8	546720.0	258666.9	68340.0
10	SLC 4	DELUGE WATER	L	151499.1	334000.0	151400.0	40000.0
10	SLC 4	NITROGEN TETROXIDE	L	6.8	15.0	4.5	1.2

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 9

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
10	SLC 4	NITROGEN TETROXIDE	L	1.8	4.0	1.1	.3
10	SLC 4	NITROGEN TETROXIDE	L	4.4	9.6	3.0	.8
10	SLC 4	NITROGEN TETROXIDE	L	.0	.0	.0	.0
10	SLC 4	OXIDIZER/WATER WASTES	L	.0	.0	.0	.0
10	CCF	SODIUM HYDROXIDE WASTEWATER	L	1381518.3	3045742.5	1381525.0	365000.0
10	17	CONTAMINATED DILUTION WATER N204	L	.0	.0	.0	.0
10	19	WASTEWATER WITH AMMONIA	L	36.3	80.0	37.8	10.0
10	19	NITROGEN TETROXIDE	L	5.4	12.0	3.8	1.0
10	19	NITROGEN TETROXIDE	L	9.8	21.6	6.8	1.8
10	19	NITROGEN TETROXIDE	L	34.3	75.6	24.2	6.4
10	19	NITROGEN TETROXIDE	L	34.3	75.6	24.2	6.4
10	19	NITROGEN TETROXIDE	L	23.9	52.6	16.7	4.4
10	19	NITROGEN TETROXIDE	L	79.5	175.2	55.3	14.6
10	19	NITROGEN TETROXIDE	L	.0	.0	.0	.0
10	19	DECONTAMINATE FROM PAYLOAD/ORB N204	L	290.3 2.7	640.0 6.0	302.8 1.9	80.0 .5
10	19	WASTE OXIDIZER AND PRIMOL 355 N204	L	37.2 2.7	82.0 6.0	37.8 1.9	10.0 .5
10	21	NITROGEN TETROXIDE	L	.0	.0	.0	.0
10	21	NITROGEN TETROXIDE	L	15.0	33.0	10.6	2.8
10	21	NITROGEN TETROXIDE	L	51.3	113.0	35.6	9.4
10	21	NITROGEN TETROXIDE	L	.0	.0	.0	.0
10	21	WASTEWATER WITH OXIDIZER N204	L	72.8 .5	160.4 1.2	75.7 .4	20.0 .1
10	23	AMMONIA	L	.0	.0	.0	.0
10	23	DELUGE WATER	L	3854112.5	8496908.0	3854130.5	1018264.4

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
		ALUMINUM OXIDE		3.4	7.4		
		AMMONIA		.2	.5		
		HYDROCHLORIC ACID		362.4	799.0		
		ORGANIC CARBON		3.4	7.5		
10	23	NITROGEN TETROXIDE	L	183.4	404.3	123.0	32.5
10	23	LBM OXIDIZER	L	.0	.0	.0	.0
		NITROGEN TETROXIDE					
10	23	NITROGEN TETROXIDE	L	.0	.0	.0	.0
10	23	N204 CONTAM. CLEANUP WATER	L	113.4	250.0	113.6	30.0
		NITROGEN TETROXIDE		1.1	2.5	1.1	.3
10	23	N204 CONTAM. WASTEWATER	L	378.3	834.0	378.5	100.0
		NITROGEN TETROXIDE		28.1	62.0	18.9	5.0
10	23	PRIMOL 355	L	340.6	751.0	378.5	100.0
		N204					
10	31	SURFACTANT	L	.0	.0	.0	.0
		NaOH					
		SODIUM TRIPOLYPHOSPHATE					
TOTALS FOR TREATMENT CATEGORY 10							
ATLAS LAUNCH FACILITIES (SLC 3)				.0	.0	.0	.0
TITAN LAUNCH FACILITIES (SLC 4)				151512.0	334028.6	151408.7	40002.3
COMPONENT CLEANING FACILITY				1381518.3	3045742.5	1381525.0	365000.0
STS NORTH VAFB (SS 17,18,19,21)				689.9	1521.0	631.3	166.8
STS SOUTH VAFB (SS 23,31,33,99)				3855128.5	8499148.0	3855124.0	1018526.9
STS PORT HUENEME (SS 32)				.0	.0	.0	.0
11	SLC 3	HYDRAZINE SCRUBBER LIQUOR	L	192.9	425.3	193.0	51.0
11	SLC 4	HYDRAZINE SCRUBBER LIQUOR	L	188.2	415.0	189.3	50.0
11	19	FUEL SCRUBBER	L	2540.1	5600.0	2649.5	700.0
		HYDRAZINE		50.8	112.0	53.0	14.0
		MMH					
11	21	FUEL SCRUBBER	L	362.9	800.0	378.5	100.0
		MMH		6.6	14.6	7.6	2.0
11	23	HYDRAZINE & MMH SCRUBBER	L	757.0	1669.0	757.0	200.0
		HYDRAZINE		16.8	37.0	15.1	4.0
		MMH		13.2	29.0	15.1	4.0
11	31	SCRUBBER EFFLUENT	L	37.6	83.0	37.8	10.0

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
11	32	HYDRAZINE SCRUBBER EFFLUENT	L	181.4	400.0	189.3	50.0
		HYDRAZINE		1.6	3.6	1.5	.4
TOTALS FOR TREATMENT CATEGORY 11							
	ATLAS LAUNCH FACILITIES (SLC 3)			192.9	425.3	193.0	51.0
	TITAN LAUNCH FACILITIES (SLC 4)			188.2	415.0	189.3	50.0
	COMPONENT CLEANING FACILITY			.0	.0	.0	.0
	STS NORTH VAFB (SS 17,18,19,21)			2903.0	6400.0	3028.0	800.0
	STS SOUTH VAFB (SS 23,31,33,99)			794.7	1752.0	794.8	210.0
	STS PORT HUENEME (SS 32)			181.4	400.0	189.3	50.0
13	SLC 3	RAGS, SOLVENT/OILY	S	53.4	117.8	68.0	2.4
13	SLC 4	RAGS, SOLVENT/OILY	S	163.3	360.0	209.5	7.4
13	19	POLYURETHANE FOAM	S	4.5	10.0	416.2	14.7
13	19	ALUMACAST A/B MIXTURE	L	.1	.3	.0	.0
		POLYOXPROPLENE PENTAERYTHRITOL					
		AROMATIC WHITE OIL					
		INERT ALUMINIZED PARTICLES					
		DIPHENYLMETHANE DIISOCYANATE					
		POLYMERS OF DPM DIISOCYANATE					
13	19	INSTANT SET POLYMER SCRAPS	S	1.8	4.0	22.7	.8
		DIPHENYL METHANE DIISOCYANATE					
		POLY(OXALKYLENE)POLYETHER					
		AROMATIC HYDROCARBONS.					
13	19	SILANE/ACETIC ACID RESIDUE	S	.5	1.0	5.7	.2
		METHYL TRIMETHOXYSILANE					
		ACETIC ACID					
13	19	KOROPON PRMER CONT PNT BRUSHES	S	18.1	40.0	141.6	5.0
		BUTYL ACETATE					
		TALC - Mg SILICATES					
		EPOXY RESIN					
13	19	CONTAMINATED PAINT BRUSHES	S	1.8	4.0	14.2	.5
		EA 911 EPOXY					
		EA 934 EPOXY					
		EA 9309 EPOXY					
13	19	RAGS WITH SOLVENTS, GREASES	S	4.5	10.0	56.6	2.0
13	19	SOLVENT-CONTAM CHEESECLOTH	S	.0	.0	.0	.0

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
		ISOPROPYL ALCOHOL METHYL ETHYL KETONE 1,1,1-TRICHLOROETHANE					
13	19	MEK & IPA CONTAM CHEESECLOTH METHYL ETHYL KETONE ISOPROPYL ALCOHOL	S	.0	.0	.0	.0
13	19	IPA CONTAMINATED CHEESECLOTH ISOPROPYL ALCOHOL	S	.0	.0	.0	.0
13	19	TCE CONTAMINATED CHEESECLOTH 1,1,1-TRICHLOROETHANE	S	.0	.0	.0	.0
13	19	MEK CONTAMINATED CHEESECLOTH METHYL ETHYL KETONE	S	.0	.0	.0	.0
13	19	IPA CONTAMINATED CHEESECLOTH ISOPROPYL ALCOHOL	S	.0	.0	.0	.0
13	19	SOLID FILM LUBRIC CONT CH3CLTH	S	.0	.0	.0	.0
13	19	IPA CONTAMINATED CHEESECLOTH ISOPROPYL ALCOHOL	S	.0	.0	.0	.0
13	19	DICHLOROMETHANE CONT CHSECLTH	S	.0	.0	.0	.0
13	21	TILE REPAIR FOAM POLYURETHANE	S	4.5 4.5	10.0 10.0	416.2 416.2	14.7 14.7
13	23	K5NA INSULATION BUTYL GLYCIDYL ETHER EPOXY RESINS, UNCURED	S	10.4	23.0	84.9	3.0
13	23	SRB PROPELLANT SPILL AMMONIUM PERCHLORATE ALUMINUM POWDER PBAN BINDER HTPB BINDER IRON OXIDE	S	.0	.0	.0	.0
13	31	K5NA & MTA-2 PACKING MATERIALS	S	2267.9	5000.0	42474.0	1500.0
13	31	MSA-1 (CURED) EPICHLORHYDRIN/BGE GLASS ECOSPHERES PHENOLIC MICROSPHERES GLASS FIBERS BENTONE 27 METHYLENE DIANILINE	S	90.7 36.3 10.7 32.2 4.0 3.0 3.2	200.0 80.1 23.6 70.9 8.8 6.7 7.0	1248.7	44.1

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
		m-PHENYLENE DIAMINE		1.3	2.9		
13	31	MTA-2 (CURED)	S	45.4	100.0	4247.4	150.0
		EPICHLORHYDRIN/BGE		14.0	30.9		
		LP-3, POLYSULFIDE LIQ POLYMER		14.0	30.9		
		MDA & mPDA		5.6	12.3		
		STANNOUS OCTOATE		.5	1.2		
		PHENOLIC MICROSPHERES		11.2	24.7		
13	31	K5NA	S	7.3	16.0	56.6	2.0
		BUTYL GLYCIDYL ETHER					
		EPOXY RESINS					
13	31	INSULATION AND PAPER	S	.0	.0	.0	.0
13	31	CONTAMINATED AIR FILTERS	S	22.7	50.0	1415.8	50.0
13	31	CHARCOAL FILTER WASTES	S	.0	.0	.0	.0
13	31	CONTAMINATED AIR FILTERS	S	22.7	50.0	1415.8	50.0
13	31	ALODINE CONTAMINATED RAGS	S	2.3	5.0	28.3	1.0
13	31	SOLVENT CONTAMINATED RAGS	S	4.5	10.0	56.6	2.0
13	31	RYMPLE CLOTHS	S	4.5	10.0	56.6	2.0
13	31	PAINT DROP CLOTHS	S	6.8	15.0	84.9	3.0
13	32	INSULATION WASTES, SOLID	S	725.7	1600.0	11326.4	400.0
		MSA-1 INSULATION					
		MTA-2 INSULATION					
		K5NA INSULATION					
		PR-855 INSULATION					
13	32	INSULATION CONTAM FILTERS	S	4.5	10.0	283.2	10.0
13	32	SRB SOLID PROPELLANT	S	.0	.0	.0	.0
		AMMONIUM PERCHLORATE					
		ALUMINUM POWDER					
		FERRIC OXIDE					
		POLYMER & EPOXY RESIN					
13	33	AIR FILTERS	S	4.5	10.0	283.2	10.0
13	99	ISOCHEM POLYESTER RESIN ADHESV	S	5.9	13.0	.0	.0
		STYRENE					
		MEK PEROXIDE CATALYST					
		DIMETHYL PHTHALATE					
13	99	BX-250 FOAM (SOFI)	S	117.9	260.0	3681.1	130.0

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
		DIPHENYL METHANE DIISOCYANATE		29.5	65.0		
		FREON 11		19.1	42.0		
		AMINES		10.4	23.0		
		POLYOLS					
		SUPER MEK PEROXIDE					
		POLYESTER RESIN					
		DIMETHYL PHTHALATE					
13	99	POUR FOAM (MIXED)	S	124.7	275.0	2775.0	98.0
		POLYURETHANE					
13	99	POUR FOAM CONTAMINATED PAPER	S	1.5	3.3	311.5	11.0
13	99	SUPER LIGHT ABLATOR (I)	S	4.5	10.0	424.7	15.0
		RESIN L664, PT A		2.7	5.9		
		SILICA FIBERS		.3	.6		
		CORK		.5	1.2		
		PHENOLIC MICROSPHERES		.1	.3		
		SILICA MICROSPHERES		.6	1.4		
		CURING AGENT		.3	.6		
13	99	SUPER LIGHT ABLATOR (II)	S	4.5	10.0	424.7	15.0
		RESIN STM L664, PT A		1.4	3.0		
		CARBON POWDER					
		SILICA FIBERS					
		CORK					
		SILICA MICROSPHERES					
		PHENOLIC MICROSPHERES					
		CURING AGENT STM L664, PT B		.8	1.7		
13	99	POUR FOAM "TRIMMINGS"	S	4.5	10.0	424.7	15.0
		POLYURETHANE					
13	99	FILTER	S	.0	.0	.0	.0
13	99	SOLVENT CONTAMINATED RAGS	S	4.5	10.0	56.6	2.0
13	99	ADHESIVE CONTAMINATED RAGS	S	4.5	10.0	56.6	2.0
13	99	EPOXY PRIMER-CONTAMINATED RAGS	S	2.3	5.0	28.3	1.0
TOTALS FOR TREATMENT CATEGORY 13							
		ATLAS LAUNCH FACILITIES (SLC 3)		53.4	117.8	68.0	2.4
		TITAN LAUNCH FACILITIES (SLC 4)		163.3	360.0	209.5	7.4
		COMPONENT CLEANING FACILITY		.0	.0	.0	.0
		STS NORTH VAFB (SS 17,18,19,21)		36.0	79.3	1073.2	37.9
		STS SOUTH VAFB (SS 23,31,33,99)		2764.8	6095.3	59636.3	2106.1
		STS PORT HUENEME (SS 32)		730.3	1610.0	11609.6	410.0
14	19	TPS ADHESIVE, RTV 566/577	S	1.1	2.5	8.5	.3

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
		PHENYL METHYL POLYSILOXANE TIN OXIDE IRON OXIDE SILICON HARDENER					
14	19	SPRAYCANS OF TPS SEALER FLUORINATED SOLVENT FREON 113	S	.0	.0	.0	.0
14	19	KOROPON PRIMER CONTAM CANS BUTYL ACETATE METHYL ETHYL KETONE TOLUENE TALC - Mg SILICATES EPOXY RESIN	S	6.8	15.0	56.6	2.0
14	19	LACQUER SPRAY CANS PIGMENT SOLIDS VEHICLE SOLIDS TOLUENE XYLENE HYDROCARBON PROPELLANT PETROLEUM DISTILLATES	S	2.7	6.0	28.3	1.0
14	19	ISP CONTAM CUPS & WOOD STICKS INSTANT SET POLYMER	S	.7	1.5	14.2	.5
14	19	MARSHALL STENCIL INK SPRAYCANS XYLENE NAPTHA OTHER MATERIALS	S	.3	.6	2.8	.1
14	19	LACQUER SPRAYCANS PIGMENT SOLIDS VEHICLE SOLIDS TOLUENE XYLENE HYDROCARBON PROPELLANT PETROLEUM DISTILLATES	S	2.2	4.8	22.7	.8
14	19	ENAMEL SPRAYCANS	S	4.1	9.0	42.5	1.5
14	19	ZINC CHROMATE PRIMER CANS	S	4.1	9.0	42.5	1.5
14	19	CONTAMINATED TARE CUPS EA 911 EPOXY EA 934 EPOXY EA 9309 EPOXY	S	.0	.0	.0	.0
14	19	CONTAMINATED BRUSHES	S	1.8	4.0	14.2	.5

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 16

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
		ORGANIC ZINC PRIMER ZINC CHROMATE PRIMER					
14	19	CONTAM CLOTHES, CLOTH & DEBRIS KOROPON BASE PRIMER KOROPON ACTIVATOR BERYLLIUM DUST	S	4.5	10.0	141.6	5.0
14	21	WASTE SEALS, FILTERS, ETC.	S	4.5	10.0	283.2	10.0
14	31	EA 934 EPOXY ADHESIVE EPOXY RESIN ASBESTOS FILLERS POLYAMIDE DIETHYLENETRIAMINE	S	15.9 6.8 1.8 3.2 3.6 .5	35.0 15.0 4.0 7.0 8.0 1.0	84.9	3.0
14	31	BOSTIK PRIMER PAINT CANS	S	6.8	15.0	56.6	2.0
14	31	BOSTIK TOPCOAT PAINT CANS	S	20.4	45.0	169.9	6.0
14	31	RUSTOLEUM PRIMER PAINT CANS	S	.9	2.0	8.5	.3
14	31	RUSTOLEUM TOPCOAT PAINT CANS	S	.9	2.0	8.5	.3
14	31	MSA-1 EMPTY CONTAINERS	S	453.6	1000.0	8494.8	300.0
14	31	K5NA CONTAINERS	S	3.4	7.5	56.6	2.0
14	32	LITHIUM STORAGE BATTERIES	S	24.5	54.0	42.5	1.5
14	32	SILVER-ZINC STORAGE BATTERIES	S	40.8	90.0	51.0	1.8
14	99	GX-6300 ABLATOR ADHESIVE RESIN STM L 663 RESIN STM L 664 SILICA POWDER CARBON POWDER CURING AGENT L 663 CURING AGENT L 664 HEPTANE XYLENE	S	5.9 .6 2.2 .2 .2 .2 .0 2.4 .1	13.0 1.3 4.8 .4 .4 .5 .1 5.2 .3	.0	.0
14	99	SOLVENT CONTAMINATED CONTAINER SOLVENTS	S	2.3	5.0	42.5	1.5
14	99	PRIMER CONTAMINATED CONTAINERS	S	.3	.7	5.7	.2
14	99	ADHESIVE CONTAMINATED CONTAINR	S	.3	.7	5.7	.2

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
14	99	SOLVENT CONTAINERS	S	.0	.0	.0	.0
14	99	POUR FOAM CONTAINERS	S	22.7	50.0	379.4	13.4
14	99	ABLATOR CONTAMINATED CONTAINER	S	.3	.7	5.7	.2
TOTALS FOR TREATMENT CATEGORY 14							
		ATLAS LAUNCH FACILITIES (SLC 3)		.0	.0	.0	.0
		TITAN LAUNCH FACILITIES (SLC 4)		.0	.0	.0	.0
		COMPONENT CLEANING FACILITY		.0	.0	.0	.0
		STS NORTH VAFB (SS 17,18,19,21)		32.8	72.4	656.9	23.2
		STS SOUTH VAFB (SS 23,31,33,99)		533.7	1176.6	9318.8	329.1
		STS PORT HUENEME (SS 32)		65.3	144.0	93.4	3.3
15	17	WASTEWATER FROM EEW&S	L	2725.4	6008.4	2725.2	720.0
15	19	WASTEWATER FROM EEW&S	L	3028.2	6676.0	3028.0	800.0
15	19	WASHWATER WITH MEK	L	42.4	93.5	45.4	12.0
		METHYL ETHYL KETONE		6.1	13.5	7.6	2.0
15	21	WASTEWATER FROM EEW&S	L	2725.4	6008.4	2725.2	720.0
15	21	WASTEWATER WITH MEK	L	42.4	93.4	45.4	12.0
		METHYL ETHYL KETONE		6.1	13.4	7.6	2.0
15	23	WASTEWATER FROM EEW&S	L	3028.2	6676.0	3028.0	800.0
15	23	SOLVENT WASTEWATER UNSPEC.	L	416.4	918.0	416.3	110.0
15	23	CONTAMINATED WASTEWATER	L	946.2	2086.0	946.3	250.0
		SOLVENTS					
		CHLORINATED RUBBER					
		ZINC PRIMER					
15	31	WASTEWATER FROM EEW&S	L	1211.3	2670.4	1211.2	320.0
15	32	WASTEWATER FROM EEW&S	L	605.6	1335.2	605.6	160.0
15	32	INSULATION-CONTAMINATED WATER	L	185291.5	408500.0	185313.6	48960.0
		MSA-1 INSULATION					
		MTA-2 INSULATION					
		K5NA INSULATION					
		PR-855 INSULATION					
15	33	WASTEWATER FROM EEW&S	L	189.1	417.0	189.3	50.0

TABLE A-1 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY

TRT CAT	FACILITY	WASTE MATERIAL	SOL/ LIQ	BASELINE MASS KILOGRAMS	BASELINE MASS POUNDS	BASELINE VOLUME LITERS	BASELINE VOLUME GAL OR CF
15	99	SOLVENT CONTAMINATED WATER	L	81.0	178.6	113.6	30.0
TOTALS FOR TREATMENT CATEGORY 15							
		ATLAS LAUNCH FACILITIES (SLC 3)		.0	.0	.0	.0
		TITAN LAUNCH FACILITIES (SLC 4)		.0	.0	.0	.0
		COMPONENT CLEANING FACILITY		.0	.0	.0	.0
		STS NORTH VAFB (SS 17,18,19,21)		8563.6	18879.7	8569.2	2264.0
		STS SOUTH VAFB (SS 23,31,33,99)		5872.2	12946.0	5904.6	1560.0
		STS PORT HUENEME (SS 32)		185897.1	409835.2	185919.2	49120.0
26	32	SRB FWD SKT CLEANING WASTES	L	.0	.0	.0	.0
TOTALS FOR TREATMENT CATEGORY 26							
		ATLAS LAUNCH FACILITIES (SLC 3)		.0	.0	.0	.0
		TITAN LAUNCH FACILITIES (SLC 4)		.0	.0	.0	.0
		COMPONENT CLEANING FACILITY		.0	.0	.0	.0
		STS NORTH VAFB (SS 17,18,19,21)		.0	.0	.0	.0
		STS SOUTH VAFB (SS 23,31,33,99)		.0	.0	.0	.0
		STS PORT HUENEME (SS 32)		.0	.0	.0	.0

TABLE A-2. BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY

TRT CAT PROGRAM	1982 POUNDS	1982 GAL OR CF	1983 POUNDS	1983 GAL OR CF	1984 POUNDS	1984 GAL OR CF	1985 POUNDS	1985 GAL OR CF	1986 POUNDS	1986 GAL OR CF	1987 & 1988 (PER YEAR) POUNDS	1987 & 1988 (PER YEAR) GAL OR CF	1989 - 1994 (PER YEAR) POUNDS	1989 - 1994 (PER YEAR) GAL OR CF
TRT CAT = 1 (RECOVERABLE FREON WASTES)														
TOTAL - TAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STS - NVAFB	0	0	0	0	0	0	20960	1600	31440	2400	52400	4000	52400	4000
STS - SVAFB	0	0	0	0	0	0	6	0	10	1	16	1	16	1
TOTAL - STS	0	0	0	0	0	0	20966	1600	31450	2401	52416	4001	52416	4001
TOTAL FOR SD	0	0	0	0	0	0	20966	1600	31450	2401	52416	4001	52416	4001
% OF SD TOTAL FROM TAC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
TRT CAT = 2 (HYPERGOLIC FUELS AND HYPERGOLIC FUEL-CONTAMINATED WATER AND ALCOHOL)														
TITAN (SLC4)	13114	1890	32786	4726	13114	1890	26229	3780	0	0	0	0	0	0
TOTAL - TAC	13114	1890	32786	4726	13114	1890	26229	3780	0	0	0	0	0	0
STS - NVAFB	0	0	0	0	0	0	7880	998	11820	1496	19700	2494	19700	2494
STS - SVAFB	0	0	0	0	0	0	35425	4315	53138	6473	88563	10788	88563	10788
STS - PH	0	0	0	0	0	0	1322	163	1983	245	3305	408	3305	408
TOTAL - STS	0	0	0	0	0	0	44627	5476	66941	8214	111568	13690	111568	13690
TOTAL FOR SD	13114	1890	32786	4726	13114	1890	70856	9256	66941	8214	111568	13690	111568	13690
% OF SD TOTAL FROM TAC	100%	100%	100%	100%	100%	100%	37%	41%	0%	0%	0%	0%	0%	0%
TRT CAT = 3 (GROUP I HYDROCARBON WASTES)														
ATLAS (SLC3)	3734	444	3734	444	3734	444	3734	444	3734	444	1867	222	0	0
TOTAL - TAC	3734	444	3734	444	3734	444	3734	444	3734	444	1867	222	0	0
STS - NVAFB	0	0	0	0	0	0	78	15	117	22	195	37	195	37
STS - SVAFB	0	0	0	0	0	0	4470	560	6705	839	11175	1399	11175	1399
TOTAL - STS	0	0	0	0	0	0	4548	574	6822	862	11370	1436	11370	1436
TOTAL FOR SD	3734	444	3734	444	3734	444	8282	1018	10556	1306	13237	1658	11370	1436
% OF SD TOTAL FROM TAC	100%	100%	100%	100%	100%	100%	45%	44%	35%	34%	14%	13%	0%	0%
TRT CAT = 4 (BILGE WATER AND WATER CONTAMINATED WITH OIL)														
TOTAL - TAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL - STS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL FOR SD	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% OF SD TOTAL FROM TAC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

TABLE A-2 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 2

TRT CAT PROGRAM	1982 POUNDS	1982 GAL OR CF	1983 POUNDS	1983 GAL OR CF	1984 POUNDS	1984 GAL OR CF	1985 POUNDS	1985 GAL OR CF	1986 POUNDS	1986 GAL OR CF	1987 & 1988 (PER YEAR) POUNDS	1987 & 1988 (PER YEAR) GAL OR CF	1989 - 1994 (PER YEAR) POUNDS	1989 - 1994 (PER YEAR) GAL OR CF
TRT CAT = 5 (GROUP II HYDROCARBON WASTES)														
ATLAS (SLC3)	13637	1214	13637	1214	13637	1214	13637	1214	13637	1214	6818	607	0	0
COMP CLN FAC	3762	330	3762	330	3762	330	5643	495	5643	495	5643	495	5643	495
TOTAL - TAC	17399	1544	17399	1544	17399	1544	19280	1709	19280	1709	12461	1102	5643	495
STS - NVAFB	0	0	0	0	0	0	62	8	94	11	156	19	156	19
STS - SVAFB	0	0	0	0	0	0	51838	4569	77758	6853	129596	11422	129596	11422
STS - PH	0	0	0	0	0	0	94	8	140	12	234	20	234	20
TOTAL - STS	0	0	0	0	0	0	51994	4584	77992	6877	129986	11461	129986	11461
TOTAL FOR SD	17399	1544	17399	1544	17399	1544	71274	6293	97271	8586	142447	12563	135629	11956
% OF SD TOTAL FROM TAC	100%	100%	100%	100%	100%	100%	27%	27%	20%	20%	9%	9%	4%	4%
TRT CAT = 8 (ACIDS, BASES, AND AQUEOUS SOLUTIONS CONTAMINATED WITH METAL IONS)														
COMP CLN FAC	609149	73000	609149	73000	609149	73000	913723	109500	913723	109500	913723	109500	913723	109500
TOTAL - TAC	609149	73000	609149	73000	609149	73000	913723	109500	913723	109500	913723	109500	913723	109500
STS - SVAFB	0	0	0	0	0	0	1336	160	2004	240	3340	400	3340	400
STS - PH	0	0	0	0	0	0	77	9	115	14	192	23	192	23
TOTAL - STS	0	0	0	0	0	0	1413	169	2119	254	3532	423	3532	423
TOTAL FOR SD	609149	73000	609149	73000	609149	73000	915136	109669	915842	109754	917255	109923	917255	109923
% OF SD TOTAL FROM TAC	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TRT CAT = 9 (SOLID ROCKET BOOSTER RINSE WATER WASTES)														
TOTAL - TAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STS - PH	0	0	0	0	0	0	2186880	273360	3280320	410040	5467201	683400	5467201	683400
TOTAL - STS	0	0	0	0	0	0	2186880	273360	3280320	410040	5467201	683400	5467201	683400
TOTAL FOR SD	0	0	0	0	0	0	2186880	273360	3280320	410040	5467201	683400	5467201	683400
% OF SD TOTAL FROM TAC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
TRT CAT =10 (ACIDIC AND BASIC WASTES WHICH CONTAIN NO SIGNIFICANT METALLIONS, PLUS OXIDIZER WASTES)														
TITAN (SLC4)	668057	80005	1670143	200012	668057	80005	1336114	160009	0	0	0	0	0	0
COMP CLN FAC	3045743	365000	3045743	365000	3045743	365000	4568615	547500	4568615	547500	4568615	547500	4568615	547500
TOTAL - TAC	3713800	445005	4715887	565012	3713800	445005	5904730	707509	4568615	547500	4568615	547500	4568615	547500
STS - NVAFB	0	0	0	0	0	0	6084	667	9126	1001	15210	1668	15210	1668
STS - SVAFB	0	0	0	0	0	0	33996592	4074108	50994888	6111162	84991488	10185268	84991488	10185268
TOTAL - STS	0	0	0	0	0	0	34002680	4074775	51004016	6112163	85006704	10186936	85006704	10186936
TOTAL FOR SD	3713800	445005	4715887	565012	3713800	445005	39907408	4782285	55572632	6659663	89575312	10734436	89575312	10734436
% OF SD TOTAL FROM TAC	100%	100%	100%	100%	100%	100%	15%	15%	8%	8%	5%	5%	5%	5%

TABLE A-2 (CONT.) BASELINE WASTE GENERATION FOR ALL SPACE DIVISION PROGRAMS BY TREATMENT CATEGORY PAGE 3

TRT CAT PROGRAM	1982 POUNDS	1982 GAL OR CF	1983 POUNDS	1983 GAL OR CF	1984 POUNDS	1984 GAL OR CF	1985 POUNDS	1985 GAL OR CF	1986 POUNDS	1986 GAL OR CF	1987 & 1988 (PER YEAR) POUNDS	1987 & 1988 (PER YEAR) GAL OR CF	1989 - 1994 (PER YEAR) POUNDS	1989 - 1994 (PER YEAR) GAL OR CF
IRT CAT =11 (FUEL VAPOR SCRUBBER WASTES)														
ATLAS (SLC3)	851	102	851	102	851	102	851	102	851	102	425	51	0	0
TITAN (SLC4)	830	100	2075	250	830	100	1660	200	0	0	0	0	0	0
TOTAL - TAC	1681	202	2926	352	1681	202	2511	302	851	102	425	51	0	0
STS - NVAFB	0	0	0	0	0	0	25600	3200	38400	4800	64000	8000	64000	8000
STS - SVAFB	0	0	0	0	0	0	7008	840	10512	1260	17520	2100	17520	2100
STS - PH	0	0	0	0	0	0	1600	200	2400	300	4000	500	4000	500
TOTAL - STS	0	0	0	0	0	0	34208	4240	51312	6360	85520	10600	85520	10600
TOTAL FOR SD	1681	202	2926	352	1681	202	36719	4542	52163	6462	85945	10651	85520	10600
% OF SD TOTAL FROM TAC	100%	100%	100%	100%	100%	100%	7%	7%	2%	2%	0%	0%	0%	0%
IRT CAT =13 (COMBUSTIBLE SOLIDS)														
ATLAS (SLC3)	236	5	236	5	236	5	236	5	236	5	118	2	0	0
TITAN (SLC4)	720	15	1800	37	720	15	1440	30	0	0	0	0	0	0
TOTAL - TAC	956	20	2036	42	956	20	1676	34	236	5	118	2	0	0
STS - NVAFB	0	0	0	0	0	0	317	152	476	227	793	379	793	379
STS - SVAFB	0	0	0	0	0	0	24381	8424	36572	12637	60953	21061	60953	21061
STS - PH	0	0	0	0	0	0	6440	1640	9660	2460	16100	4100	16100	4100
TOTAL - STS	0	0	0	0	0	0	31138	10216	46708	15324	77846	25540	77846	25540
TOTAL FOR SD	956	20	2036	42	956	20	32814	10250	46943	15329	77964	25542	77846	25540
% OF SD TOTAL FROM TAC	100%	100%	100%	100%	100%	100%	5%	0%	1%	0%	0%	0%	0%	0%
IRT CAT =14 (NONCOMBUSTIBLE SOLIDS)														
TOTAL - TAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STS - NVAFB	0	0	0	0	0	0	290	93	434	139	724	232	724	232
STS - SVAFB	0	0	0	0	0	0	4706	1316	7060	1975	11766	3291	11766	3291
STS - PH	0	0	0	0	0	0	576	13	864	20	1440	33	1440	33
TOTAL - STS	0	0	0	0	0	0	5572	1422	8358	2134	13930	3556	13930	3556
TOTAL FOR SD	0	0	0	0	0	0	5572	1422	8358	2134	13930	3556	13930	3556
% OF SD TOTAL FROM TAC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
IRT CAT =15 (MISCELLANEOUS WASTEWATERS)														
TOTAL - TAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STS - NVAFB	0	0	0	0	0	0	75519	9056	113278	13584	180797	22640	180797	22640
STS - SVAFB	0	0	0	0	0	0	51784	6240	77676	9360	129460	15600	129460	15600
STS - PH	0	0	0	0	0	0	1639341	196480	2459011	294720	4098352	491200	4098352	491200
TOTAL - STS	0	0	0	0	0	0	1766644	211776	2649965	317664	4416610	529440	4416610	529440
TOTAL FOR SD	0	0	0	0	0	0	1766644	211776	2649965	317664	4416610	529440	4416610	529440
% OF SD TOTAL FROM TAC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%